TABLE 5.15

ESTIMATED HEDONIC EQUATION (SEMI-LOG) FOR THE SOUTH COAST AIR BASIN.
DEPENDENT VARIABLE = ln(HOME SALE PRICE IN 1978-79 DOLLARS)

Variables	Coefficient	t-statistic
Site Specific Characteristics:		
Sales Date	$.1481 * 10^{-1}$	28.61
Age of Home	$-.1658 * 10^{-2}$	-8.02
Square Feet of Living Area	$.4012 * 10^{-3}$	46.86
Number of Bathrooms	$.6320 * 10^{-1}$	8.66
Number of Fireplaces	$.7606 * 10^{-1}$	12.38
Pool	$.7788 * 10^{-1}$	8.59
View	.1481	12.85
Community Characteristics:		
School Quality	$.1256 * 10^{-3}$	1.36
Population Density	$-.7807 * 10^{-5}$	-4.32
% White	$.8055 * 10^{-2}$	33.53
% Greater Than 62 Years Old	$.1839 * 10^{-2}$	2.54
Pollution (TSP)	$-.7811 * 10^{-2}$	-18.82
Pollution (Ozone)	$-.1973 * 10^{-2}$	-1.58
Location Characteristics:		
Time to Employment	$.1257 * 10^{-2}$	1.25
LN(Distance to the Beach)	$-.6899 * 10^{-1}$	-11.36
Los Angeles County	$.9084 * 10^{-1}$	4.16
Orange County	-.1466	-6.28
San Bernardino	-.2031	-9.01
Constant	5.882	114.77
R-Squared	.80	
Number of Observations	4951	

The central point is that the estimated equation in Table 5.15 looks reasonable in every respect. However, the results are very unstable with the ozone variable demonstrating substantial variation for small changes in either functional form or random samples. For instance, the use of distance to beach rather than ℓn (distance to beach) reverses the sign of the ozone variable. Similarly, using the light extinction variable rather than total suspended particulates as a measure of aesthetic air quality alters the ozone coefficient markedly. In fact, the functional form presented is one of only a limited number of forms which produced a negative and significant relationship between ozone concentrations and home sale price. This inherent instability strips the results of any meaning.

Therefore, in an attempt to break the collinearity between distance to beach and ozone the data set was expanded to include outlying areas. This effort reduced the simple correlation between these variables by a significant amount. Further, we were able to estimate an equation which could be perceived as correct. However, the ozone coefficient is inherently unstable, subject to large variation in both magnitude and sign. The conclusion is that harmful collinearity in the data set has not been appropriately solved. In the next section we report on the use of principal components analysis which does produce stable results.

D.6 Empirical Results - Principle Components Analysis

Principle component analysis is a method of transforming a given set of variables into a new set of composite indices or principle components that are orthogonal (uncorrelated) to each other. Because of the severe collinearity in this study a transformation that yields uncorrelated variables is particularly useful. The transformation is accomplished by choosing the best linear combination of the variables. In this context best implies that the combination chosen accounts for more of the variance in the data than any other linear combination of variables. The first principle component is therefore viewed as the single best summary of linear relationships exhibited in the data. The second component is defined as the second best linear combination of variables, given the condition that the second is orthogonal to the first. This continues until all the variation in the data is explained.

The principle component method can be expressed as:

$$X_i = a_{i1}F_1 + a_{i2}F_2 + a_{iK}F_K \qquad (5.23)$$

where

X_i = the variables included in the principle component analysis ($i = 1, 2, \ldots, m$)

F_j = the principle components or factors ($j = 1, 2, \ldots, K$) , $K \leq M$

a_{ij} = estimated coefficients

If the number of factors equals the number of variables (K=M) then the entire variation in the variables is explained by the factors. However, it

is the usual case to use fewer factors than variables because if the two are equal then the procedure is identical to not using principal components analysis (Johnston, 1972).

The estimated coefficients are important in that they indicate the relative importance of each factor. The importance of a given factor for a given variable can be expressed in terms of the variance in the variable that is explained by the factor. Mathematically this is the square of the estimated coefficient (a_{ij}^2). The total variation of a variable explained by all factors is obtained by summing the squared coefficients

$$\left(\sum_{j=1}^{K} a_{ij}^2 \right).$$

Given the relationships described in equation (5.23) the original data is transformed into a set of composite scales or factor scores that represent the relative importance of the respective factors or principle components. In order to do this the matrix of a_{ij} is transformed into a factor score coefficient matrix. The composite scales or factor scores are then calculated as:

$$Z_j = b_{1j}(X_1 - \bar{X}_1)/\sigma_1 + b_{2j}(X_2 - \bar{X}_2)/\sigma_2 + \ldots + b_{Mj}(X_m - \bar{X}_m)/\sigma_m \qquad (5.24)$$

where

Z_j = factor score representing the j^{th} factor (j = 1, 2, . . ., K)

b_{ij} = factor score coefficient (i = 1, 2, . . ., m)

X_i = original data (i = 1, 2, . . ., M)

$\bar{X}_i$ = mean of the i^{th} independent variable

σ_i = standard deviation of the i^{th} independent variable.

Note that the original data is standardized as an alternative to measuring all variables in the same units (Johnston, 1972).

The factor scores represent the transformed data set in which orthogonality is preserved. This new data is then input into the home sale price hedonic equation as explanatory variables. In essence, a set of highly correlated variables are replaced by a new set of uncorrelated variables which measure precisely the same information. However, it should be noted that the initial variables have been constrained to a linear relationship. Essentially, the procedure represents the imposition of a linear restriction, where the linear relationship is not based on a priori information but is chosen as the one which best fits the data.

In the semi-log form the hedonic equation can be written as:

$$\ell n(HSP) = \beta_0 + \sum_{j=1}^{K} \beta_j Z_j + \sum_{i=M}^{N} \lambda_i X_i \qquad (5.25)$$

where

HSP = home sale price

Z_j = factor scores representing the principle components ($j = 1, 2, \ldots K$)

X_i = remaining explanatory variables not included in the principle component analysis

β_0, β_j, λ_i = estimated coefficients.

Since the principle components are linear combinations of other variables no precise interpretation can be given to the factor score variables. However, one can still determine the relative effect of a change in a variable included in the principle component analysis by differentiating equation (5.25) with respect to that variable. For instance, consider the impact of X_1, a variable included in the principle component analysis. Substituting equation (5.24) into (5.25) and differentiating, we obtain

$$\frac{\partial HSP}{\partial X_1} = \frac{\partial HSP}{\partial Z_1}\frac{\partial Z_1}{\partial X_1} + \ldots + \frac{\partial HSP}{\partial Z_K}\frac{\partial Z_K}{\partial X_1}$$

$$= e^{(\beta_0 + \sum_{j=1}^{K} \beta_j Z_j + \sum_{i=m}^{N} \lambda_i X_i)} \left(\frac{\beta_1 b_{11}}{\sigma_1} + \frac{\beta_2 b_{12}}{\sigma_1} + \ldots + \frac{\beta_K b_{1K}}{\sigma_1}\right) \qquad (5.26)$$

Thus, although X_1 does not enter the hedonic housing equation directly its relative importance can still be determined.

In the particular situation under study there exists severe collinearity between ozone concentrations and distance to beach. Thus, it was decided to perform principle component analysis on these troublesome variables to transform them into a set of uncorrelated variables. Two different approaches were utilized. In each case distance to beach, ozone and a variable measuring aesthetic air quality were included as variables to be transformed. The first used TSP, the second used light extinction. In each case two factors were used to explain the variables.

The initial factor matrix for beach, ozone and TSP is presented in Table 5.16 (top). The bottom portion of the table presents the distance to beach, ozone, extinction case. As is illustrated the first factor or principle component largely explains distance to beach and ozone concentrations. In both cases the aesthetic measure loads up on the second

TABLE 5.16

FACTOR COEFFICIENT MATRIX

Variable	Factors	
	Factor 1	Factor 2
Distance to Beach	.85105	.30095
Ozone	.90116	.18974
TSP	.2597	.96397
Distance to Beach	.80893	.39651
Ozone	.92789	.14043
Extinction	.23856	.9626

factor. The two factors explain approximately 89 percent of the variation in the variables in each case.

As outlined above the initial factor matrix is transformed into a factor score coefficient matrix. The relevant matrices are presented in Table 5.17. These factor score coefficients are used to compute factor scores or composite scales which represent the relative importance of each factor for each variable. This is accomplished in accordance with equation (5.24). The factor scores are input data (explanatory variables) into the hedonic housing equation. The expected sign of each of the factors is negative since each represents negative influences on home sale price.

The hedonic housing equation using principle components to transform distance to beach, ozone and TSP and estimated on the South Coast Air Basin sample (4,951 observations) is presented in Table 5.18. The hedonic equation which is based on distance to beach, ozone and extinction is sufficiently similar as to not warrant inclusion here.

As is illustrated the estimated log-linear equation performs quite well when considering proportion of explained variation ($\bar{R}^2$ = .79) and t-statistics. Note that time to employment has been replaced by distance to the central business district. As a locational indicator the latter seems to outperform the ubiquitous time to work variable. Also, Los Angeles County is the excluded zero-one variable. This has no effect on the results but makes the signs of the zero-one location variables consistently negative.

The estimated equation also appears to be quite stable with respect to experimental functional forms and randomly drawn samples. However, only a preliminary analysis has been conducted.

The non-linear specification presents straightforward analysis of the quantitative impact of a unit change in an independent variable since the effect depends upon the level of all other variables. However, if ozone and all other variables are assigned their mean values then a one unit improvement in ozone (PPHM) is valued at $852.

The estimated equation shown in Table 5.18 yield the marginal willingness to pay for ozone reductions by taking the derivative with respect to ozone. This procedure supplies information on the amount that each household is willing to pay in house price differentials for changes in ozone concentrations. These home sale price differentials are used in the next section for comparison to the survey results.

D.7 Summary

This section reports on an attempt to validate the survey results of the previous section through an analysis of the housing market. The housing value study was conducted initially in Los Angeles County. However, severe collinearity between variables prevented the estimation of an accurate hedonic housing equation. A variety of solutions often cited in the literature were attempted but within Los Angeles the collinear

TABLE 5.17

FACTOR SCORE COEFFICIENT MATRIX

Distance to Beach, Ozone, TSP		Distance to Beach, Ozone, Extinction	
Factor 1	Factor 2	Factor 1	Factor 2
.5628	-.0761	.4897	.0572
.6667	0.2480	.7300	-.3231
-.3069	1.1099	-.3082	1.062

TABLE 5.18

ESTIMATED HEDONIC EQUATION (LOG-LINEAR) FOR THE SOUTH COAST AIR BASIN. DEPENDENT VARIABLE = 1n(HOME SALE PRICE IN 1978-79 DOLLARS)

Variables	Coefficient	t-statistic
Site Specific Characteristics:		
1n(Sales Date)	$.98 * 10^{-1}$	23.76
1n(Age of Home)	$.11 * 10^{-1}$	-6.11
1n(Square Feet of Living Area)	.709	46.75
1n(Number of Bathrooms)	$.928 * 10^{-1}$	6.72
Number of Fireplaces	$.738 * 10^{-1}$	11.45
Pool	$.912 * 10^{-1}$	9.68
View	.192	16.30
Community Characteristics:		
1n(Schoo1 Quality)	$.65 * 10^{-1}$	2.57
1n(Population Density)	$-.456 * 10^{-1}$	-6.24
1n(% White)	.367	34.14
1n(% Greater Than 62 Years Old)	$.201 * 10^{-1}$	3.05
Location Characteristics:		
1n(Distance to Central Business District)	$-.132 * 10^{-1}$	-4.84
Riverside County	$-.906 * 10^{-1}$	-4.03
Orange County	-.247	-27.63
San Bernardino County	-.253	-18.23
Factors		
Factor 1	-.11	-28.39
Factor 2	-.122	-30.76
Constant	-.19	-1.12
R-Squared	.79	
Number of Observations	4951	

relationships could not be broken. Therefore, the study area was expanded to include the other counties of the South Coast Air Basin. In addition, the harmful collinearity was reduced through the use of principle components analysis. In the latter approach a linear restriction is imposed on the problem variables. The end result was a stable estimated hedonic equation that satisfied the usual statistical tests. More extensive work should further refine the model.

The final equation includes both ozone concentrations and another variable which measures the aesthetic aspect of air quality. The relative impact of ozone concentrations can be analyzed by differentiating the equation with respect to ozone. The resulting home sale price change measures the marginal willingness to pay for a marginal ozone change. These figures are not strictly interpretable as benefit measures but can be compared to the survey results as a validation test in accordance with Brookshire et al. (1982). As is described in the next section the home sale price differential closely parallels the survey results.

E. PRELIMINARY COMPARISON BETWEEN SURVEY AND HEDONIC HOUSING VALUE RESULTS

The ozone experiment conducted in the South Coast Air Basin represents an attempt to place a monetary value on ozone concentration reductions. This is accomplished through use of both the survey approach and an analysis of housing values. The survey was undertaken in six communities, spanning three air quality areas. Individual households were asked to value daily ozone improvements consistent with these air quality zones. Variation across income class was an important variable in survey design.

The housing value analysis was not limited to a set of individual communities but rather used data from the four counties (Los Angeles, Orange, Riverside, San Bernardino) in the South Coast Air Basin. This more extensive data base was required to accurately estimate the hedonic price gradient. The objective of the housing value exercise was to determine the hedonic or implicit price of ozone concentrations (annual average) as they impact residential housing values.

In this section these diverse methodologies are brought together so that a preliminary comparison of the values associated with ozone reductions can be completed. The comparison is restricted to the six communities (three air quality areas) in which the survey was conducted. The air quality zones are labelled Poor (West San Gabriel Valley), Fair (West San Fernando Valley), and Good (North Orange County). The comparison is done on an annual basis. Thus, for each methodology a conversion of the basic values obtained is necessary.

Consider first the survey approach. The survey was directed at determination of the value of ozone reductions on a single "memorable" day. However, the theoretical model presented above suggests that utility functions may be daily separable. This implies that daily bids are both separable and additive. Thus, an annual bid may be obtained for a specific

air quality change by multiplying the daily bid by the number of days to be altered.

In each air quality region the respective frequency distribution of days that the representative air quality standards (federal standard, stage one alert, stage two alert) are violated are depicted in Table 5.19. As is indicated the Poor air quality region has relatively more high ozone days and less low ozone days than either of the other regions. In a like manner the Fair region has relatively worse air quality than the region labelled good.

The particular air quality change that is analyzed here corresponds to a shift of the frequency distribution from Poor to Fair and from Fair to Good. Thus, the West San Gabriel Valley is assumed to change from the present state to ozone concentrations consistent with the West San Fernando Valley. Further, the West San Fernando Valley is to experience air quality levels that now exist in the North Orange County communities.

Given the number of days to be affected, the final data input necessary to calculate an annual bid from survey responses are the individual bids for each category. The mean bids across individuals are presented in Table 5.20. As is illustrated, West San Gabriel respondents bid for three air quality improvements (D-C, C-B, B-A). On the other hand there are only two bids for West San Fernando respondents since they experience no days with second stage smog alerts. These mean bids represent marginal bids since, for instance, West San Gabriel individuals were asked to bid from D to C, D to B and D to A. Thus, the figures in Table 5.20 are the differences between bids (marginal bids) for the changes D to C, C to B and B to A.

For each individual in an air quality region an annual bid is determined through a simple summation of the daily bids. Each daily bid represents the households daily marginal bid for the air quality change for that day. For instance, if the air quality in the poor region is improved to fair levels then the individual would receive 8 less D days, 77 less C days and 84 less B days. Multiplying the individuals value of the air quality changes by these figures and summing yields the annual bid for a change from Poor to Fair. In a similar manner the value that a West San Fernando household places on a Fair to Good improvement is determined by multiplying daily bids by the number of days changed. For comparison to the housing value results the individual annual values are deflated to reflect 1979 dollar values.

The means and standard deviations of these annual bids are presented in Table 5.21. The range of values represents the basic difference between interview and mail respondents.

For comparison to the calculated values obtained from survey responses, an annual bid was estimated from the hedonic housing value study. The primary output from an estimated hedonic housing equation is the implicit price of each characteristic. If the estimated equation is non-linear then this implicit price is not independent of other variables

TABLE 5.19

OCCURRENCE OF DAILY PEAK OZONE LEVELS BY AIR QUALITY AREA, 1978

	AIR QUALITY AREA		
	West San Gabriel Valley	West San Gernando Valley	North Coastal Orange County
Air Quality (Ozone, pphm)	Number of Days		
D(35-50 pphm)	8	0	0
C(20-35 pphm)	85	16	3
B(12-20 pphm)	59	52	22
A(0-12 pphm)	213	297	340

TABLE 5.20

MEAN AND STANDARD DEVIATION OF MARGINAL BIDS
FOR OZONE REDUCTIONS ($1982)

	AIR QUALITY AREA			
	West San Gabriel Valley		West San Fernando Valley	
	Interview Respondents	Mail Respondents	Interview Respondents	Mail Respondents
D	--	--	--	--
C	9.01 (21.93)	7.72 (16.77)		
B	1.32 (2.24)	3.09 (6.78)	3.91 (5.65)	7.85 (17.95)
A	6.88 (19.58)	8.78 (18.71)	2.51 (6.51)	2.08 (8.37)

TABLE 5.21

ANNUAL VALUES FOR OZONE REDUCTIONS ($1978)

	Means and Standard Deviations (in parentheses) Air Quality Improvement	
	Poor - Fair	Fair - Good
Interview Respondents	502 (1166)	106 (227)
Mail Respondents	692 (1238)	128 (325)
Hedonic Housing Value	346 - 731 (191) - (453)	153 - 371 (76.7) - (162)

in the equation. Such is the case in this study. This implicit price or marginal willingness to pay is given as the home sale price differential for a marginal charge in the characteristic and is, in essence, a marginal bid for the particular characteristic. Thus, for a given change in the attribute this marginal willingness to pay or home sale price differential can be precisely compared to the bids obtained from the survey.

The basic procedure then is to first calculate the home sale price for each individual in the comparison areas for the initial air quality conditions. The next step is to calculate the home sale price for the subsequent air quality. The differential between these two calculations represents the home sale price differential attributable to the air quality change. This is equivalent to differentiating the hedonic housing equation with respect to ozone concentrations and evaluating over the relevant change. Various hedonic equations are used, the primary differences being functional form and the variable used to describe the aesthetic component of air quality (light extinction or total suspended particulates).

The hedonic housing approach uses annual average ozone data to describe ozone concentrations spatially. Thus, the shift downward in the frequency distribution described above is translated into a change in the annual average to calculate the home sale price differential. For instance, the frequency distributions for the three air quality areas imply approximate annual averages of 13.77, 8.8 and 7.17 pphm, respectively. The home sale price differential is calculated for each individual household for these changes (13.77 - 8.8, 8.8 - 7.17).

Home sale price differentials are calculated for each household in the comparison areas. These represent home sale price changes over the life of the home. These values are converted to annual differentials using the standard annualization procedure (interest rate = .095). The means and standard deviations for each proposed air quality change are presented in Table 5.21. The lower portion of the range is based on the log-linear functional form and the use of total suspended particulates to measure the aesthetic aspect of air quality. The upper portion of the estimated range relies on the model which uses the semi-log functional form and the light extinction variable.

It appears from an examination of Table 5.21 that surveys and hedonic housing studies yield comparable values for the proposed ozone reductions. If anything, surveys seem to produce lower valuations than an analysis of. housing values. But this is consistent with the theoretical model in Brookshire et al. (1982). The closeness of the valuations also lend support to the theoretical model specified above that assumes daily separability of the bids. However, this comparison is only preliminary. Only after substantial in-depth statistical examination and comparability checks between the two studies will the researchers be able to state unequivocally how the valuations compare.

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1. The sale price or the discounted value of the flow of rents rather than actual rent is used as the dependent variable. The two are interchangeable given the appropriate discount rate.

2. 1978 was chosen as the year of analysis because that is the last year of data that was available. This makes the comparison to the survey results somewhat tentative but that is all that was possible given the data limitations.

3. See Freeman (1979) and Mäler (1979) for reviews of estimating hedonic housing equations.

4. For a complete discussion of these issues see "Seasonal and Diurnal Variation in California's South Coast Air Basin", by M. Hoggan, A. Davidson and D. Shikiga of the South Coast Air Quality Management District.

5. The results are not affected by functional form.

6. See J. Trijonis et al. "Development of Methods to Estimate the Benefits of Visibility Improvement," California Air Resources Board, on going project, 1983.

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APPENDIX A

SURVEY QUESTIONNAIRES: MAIL AND INTERVIEWER

Dear Californian:

We are a research team at the University of Wyoming conducting a study related to air quality improvements. Air quality is a familiar topic to people who live in the Los Angeles area. Also, many people are interested in the benefits of having cleaner air.

However, cleaning up the air involves certain costs to society in which all people will share in one way or another. We are interested in finding out whether it is worth it for the people in Los Angeles to pay these costs in light of the benefits they receive from cleaner air.

We would appreciate it if you would take the time to answer some questions which will be helpful in discovering whether pollution control is worthwhile. Before answering these questions, please read through the following information on measuring air quality. Your answers will be held in strict confidence. A postage paid return envelope is enclosed to return the questionnaire form.

Thank you for your cooperation.

SAN GABRIEL VALLEY SURVEY

Air pollution in the Los Angeles area consists of a variety of gases and particles. Some of these are emitted directly by pollution sources (cars, trucks, industrial facilities) while others are formed in the air from these directly emitted pollutants.

Ozone, the most important gaseous air problem in the South Coast Air Basin, is created when certain other emissions are exposed to sunlight. Ozone is an important air problem because of its effects on human health and well-being.

Please find and open the enclosed sheet of illustrations.

The left-hand side shows the daily maximum ozone concentrations in your area during August and September of this year.

The right-hand side presents a summary of known effects of breathing ozone on humans and experimental animals. The effects are the result of relatively short-term exposure to ozone concentrations that are possible in the South Coast Air Basin.

Ozone concentrations in the air are measured in parts per hundred million. This is a common way of measuring ozone levels.

On this scale a measure of 5 is very clean air for the Los Angeles area. A rating of 40 is very smoggy.

The Federal Standard for ozone requires an hourly average concentration of ozone less than 12 (all references to ozone concentration will be in parts per hundred million).

A Stage One Ozone Episode is called when ozone concentrations reach 20.

A Stage Two Ozone Episode requires an hourly average of 35. There have been no Stage Three Ozone Episodes, which require a concentration of 50, since 1974.

Some of the effects of ozone levels are:

- Concentrations meeting the Federal Standard (0-12). Ozone levels in this range are identified as Situation A, GOOD air quality, on the illustration.

  • ODOR BRIEFLY NOTICEABLE

  Most people notice the pungent smell of ozone at concentrations around 2. At 5 the "smell" fades in about 5 minutes even if the ozone remains.

- Federal Standard violated (12-20). Ozone levels in this range are identified as Situation B, FAIR air quality, on the illustration.

  • DECREASED ATHLETIC PERFORMANCE

    Athletes performing outdoors show slower speeds in running.

  • LOWER RESISTANCE TO LUNG INFECTION

    Some laboratory animals get lung infections more readily.

  • SENSITIVE ASTHMATICS HAVE MORE FREQUENT ATTACKS

    The people with asthma who are most sensitive to ozone have more frequent coughing spells.

- Stage One Ozone Episode (20-35). Ozone levels in this range are identified as Situation C, POOR air quality, on the illustration.

  • COUGH, CHEST DISCOMFORT, HEADACHE

    Healthy adults notice discomfort in breathing, get headaches, and cough.

  • MORE FREQUENT ASTHMA ATTACKS

    More frequent coughing spells are had by people with asthma.

  • RED BLOOD CELL SPHERING

    Changes in the appearance of red blood cells were noticed in human volunteers.

  • DECREASED VISION, CONCENTRATION

    Human volunteers exposed to ozone had decreased sharpness of vision and had more difficulty concentrating. This may contribute to the higher number of automobile accidents when ozone levels rise.

- Stage Two Ozone Episode (35-50). Ozone levels in this range are identified as Situation D, VERY POOR air quality, on the illustration.

  • DECLINE IN LUNG FUNCTION IN HEALTHY INDIVIDUALS

    Human volunteers exposed to ozone at this level had a noticeable decrease in various lung functions. At this level ozone is certainly more than an inconvenience; it presents a health hazard to people.

All effects of ozone at lower concentrations continue at higher concentrations. In the right-hand-side of the illustration these effects are repeated as ozone levels rise. Ozone, however, is not usually the cause of eye irritation. Other pollutants in smog are responsible for the stinging eyes.

The left-hand side of the illustrations shows the daily high ozone concentration in your area during last August and September.

Please notice the very high readings just before Labor Day Weekend and three weeks later on September 22 and 23. Between these periods of high ozone levels was a period of exceptionally low ozone levels. Earlier in the summer there were rather large day-to-day variations in daily high ozone readings.

Thursday, September 2, was a day with relatively high ozone concentrations in your area. It was the Thursday before Labor Day weekend and is marked on the left-hand-side of the illustration with a solid arrow. This was a day with VERY POOR ozone levels, such as Situation D as shown on the illustration.

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Thursday, September 2?

_____ Yes _____ No (Please Check)

2. If you answered yes , which of these symptoms did you notice?

Symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____
Other (please name)	_____	

The principle source of emissions which yield ozone is exhaust from cars and trucks. Factories, refineries, and other industrial facilities, also produce a significant amount of emissions.

A reduction in ozone levels will require the use of more costly procedures in manufacturing and in higher operating costs for automobiles and trucks. All of this would be reflected in higher prices for goods and services.

Over the Labor Day weekend, ozone levels dropped some in your area, to Situation C. There were numerous other days in August and September with C, POOR air quality.

Try to imagine a summer day with VERY POOR ozone levels, such as situation D as shown in the illustration.

Ozone levels could be reduced on that day by imposing regulations requiring the use of more expensive procedures as mentioned above. If such regulations were imposed you would be "paying" for an ozone reduction.

3. What is the most your household would be willing to pay to reduce the daily high ozone reading on that day from VERY POOR to POOR? Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

4. What is the most your household would be willing to pay to reduce the daily high ozone level on that day from VERY POOR to FAIR? Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

5. What is the most your household would be willing to pay to reduce the daily high ozone level on that day from VERY POOR to GOOD? Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

6. Answer only if you answered $.00 to questions 3 through 5 above.

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

7. In what outdoor activities do you regularly participate? How often?

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging	_____	_____	_____
Sailing	_____	_____	_____

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Tennis	_____	_____	_____
Surfing	_____	_____	_____
Swimming	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Do you change your behavior on days with high ozone levels? If so, how?

	At what levels of ozone? B	C	D
Drive less	____	____	____
Exercise at different hours	____	____	____
Stay indoors	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education:
- under 12 years _____
- High School _____
- College - no degree _____
- Bachelor's degree _____
- Post-graduate degree _____

15. Your age group:
- under 18 _____
- 18-24 _____
- 25-34 _____
- 35-44 _____
- 45-54 _____
- 55 & over _____

16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Would you please indicate which of the following groups your annual before tax household income falls in:

_____ less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000-7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500-9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,999	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

20. Do you live in a detached house, duplex, apartment or mobile home?

(1) House	(2) Duplex	(3) Apartment	(4) Mobile Home
_____	_____	_____	_____

21. Do you own or rent your home? ____own ____rent

SAN FERNANDO VALLEY SURVEY

Air pollution in the Los Angeles area consists of a variety of gases and particles. Some of these are emitted directly by pollution sources (cars, trucks, industrial facilities) while others are formed in the air from these directly emitted pollutants.

Ozone, the most important gaseous air problem in the South Coast Air Basin, is created when certain other emissions are exposed to sunlight. Ozone is an important air problem because of its effects on human health and well-being.

Please find and open the enclosed sheet of illustrations.

The left-hand side shows the daily maximum ozone concentrations in your area during August and September of this year.

The right-hand side presents a summary of known effects of breathing ozone on humans and experimental animals. The effects are the result of relatively short-term exposure to ozone concentrations that are possible in the South Coast Air Basin.

Ozone concentrations in the air are measured in parts per hundred million. This is a common way of measuring ozone levels.

On this scale a measure of 5 is very clean air for the Los Angeles area. A rating of 40 is very smoggy.

The Federal Standard for ozone requires an hourly average concentration of ozone less than 12 (all references to ozone concentration will be in parts per hundred million).

A Stage One Ozone Episode is called when ozone concentrations exceed 20.

A Stage Two Ozone Episode requires an hourly average of 35. There have been no Stage Three Ozone Episodes, which require a concentration of 50, since 1974.

Some of the effects of ozone levels are:

o Concentrations meeting the Federal Standard (0-12). Ozone levels in this range are identified as Situation A, GOOD air quality, on the illustration.

• ODOR BRIEFLY NOTICEABLE

Most people notice the pungent smell of ozone at concentrations around 2. At 5 the "smell" fades in about 5 minutes even if the ozone remains.

- Federal Standard violated (12-20). Ozone levels in this range are identified as Situation B, FAIR air quality, on the illustration.

  - DECREASED ATHLETIC PERFORMANCE

    Athletes performing outdoors show slower speeds in running.

  - LOWER RESISTANCE TO LUNG INFECTION

    Some laboratory animals get lung infections more readily.

  - SENSITIVE ASTHMATICS HAVE MORE FREQUENT ATTACKS

    The people with asthma who are most sensitive to ozone have more frequent coughing spells.

- Stage One Ozone Episode (20-35). Ozone levels in this range are identified as Situation C, POOR air quality, on the illustration.

  - COUGH, CHEST DISCOMFORT, HEADACHE

    Healthy adults notice discomfort in breathing, get headaches, and cough.

  - MORE FREQUENT ASTHMA ATTACKS

    More frequent coughing spells are had by people with asthma.

  - RED BLOOD CELL, SPHERING

    Changes in the appearance of red blood cells were noticed in human volunteers.

  - DECREASED VISION, CONCENTRATION

    Human volunteers exposed to ozone had decreased sharpness of vision and had more difficulty concentrating. This may contribute to the higher number of automobile accidents when ozone levels rise.

- Stage Two Ozone Episode (35-50). Ozone levels in this range are identified as Situation D, VERY POOR air quality, on the illustration.

  - DECLINE IN LUNG FUNCTION IN HEALTHY INDIVIDUALS

    Human volunteers exposed to ozone at this level had a noticeable decrease in various lung functions. At this level ozone is certainly more than an inconvenience; it presents a health hazard to people.

All effects of ozone at lower concentrations continue at higher concentrations. In the right-hand-side of the illustration these

effects are repeated as ozone levels rise. Ozone, however is not usually the cause of eye irritation. Other pollutants in smog are responsible for the stinging eyes.

The left-hand side of the illustrations shows the daily high ozone concentration in your area during last August and September.

Please notice the very high readings just before and during Labor Day Weekend and three weeks later on September 22 and 23. Between these periods of high ozone levels was a period of exceptionally low ozone levels. Earlier in the summer there were rather large day-to-day variations in daily high ozone readings.

Saturday, September 4, was a day with relatively high ozone concentrations in your area. It was the Saturday of Labor Day weekend and is marked on the left-hand-side of the illustration with a solid arrow. This was a day with POOR ozone levels, such as Situation C as shown on the illustration.

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Saturday, September 4?

_____ Yes _____ No (Please Check)

2. If you answered yes, which of these symptoms did you notice?

Symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____
Other (please name)_____		

The principle source of emissions which yield ozone is exhaust from cars and trucks. Factories, refineries, and other industrial facilities, also produce a significant amount of emissions.

A reduction in ozone levels will require the use of more costly procedures in manufacturing and in higher operating costs for automobiles and trucks. All of this would be reflected in higher prices for goods and services.

Over the Labor Day weekend, ozone levels dropped some in your area, to Situation B. There were numerous other days in August and September with B, FAIR air quality.

Try to imagine a summer day with POOR ozone levels, such as Situation C as shown in the illustration.

Ozone levels could be reduced on that day by imposing regulations requiring the use of more expensive procedures as mentioned above. If such regulations were imposed you would be "paying" for an ozone reduction.

4. What is the most your household would be willing to pay to reduce the daily high ozone reading on that day from POOR to FAIR?
Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

5. What is the most you would be willing to pay to reduce the daily high ozone level on that day from POOR to GOOD?
Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

6. Answer only if you answered $.00 to questions 4 through 5 above.

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

7. In what outdoor activities do you regularly participate? How often?

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging . . .	_____	_____	_____
Sailing . . .	_____	_____	_____
Tennis	_____	_____	_____
Surfing . . .	_____	_____	_____
Swimming . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____

8. Do you change your behavior on days with high ozone levels? If so, how?

	At what levels of ozone? B	C	D
Drive less	____	____	____
Exercise at different hours	____	____	____
Stay indoors	____	____	____
_____	____	____	____

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____NO

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education:
- under 12 years _____
- High School _____
- College - no degree _____
- Bachelor's degree _____
- Post-graduate degree _____

15. Your age group:
- under 18 _____
- 18-24 _____
- 25-34 _____
- 35-44 _____
- 45-54 _____
- 55 & over _____

16. Sex : _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000-7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500-9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,999	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

20. Do you live in a detached house, duplex, apartment or mobile home?

(1) Detached	(2) Duplex	(3) Apartment	(4) Mobile Home
_____	_____	_____	_____

21. Do you own or rent your home? ____own ____rent

Dear Californian:

We are a research team at the University of Wyoming conducting a study related to air quality improvements. Air quality is a familiar topic to people who live in the Los Angeles area. Also, many people are interested in the benefits of having cleaner air.

However, cleaning up the air involves certain costs to society in which all people will share in one way or another. We are interested in finding out whether it is worth it for the people in Los Angeles to pay these costs in light of the benefits they receive from cleaner air.

We would appreciate it if you would take the time to answer some questions which will be helpful in discovering whether pollution control is worthwhile. Before answering these questions, please read through the following information on measuring air quality. Your answers will be held in strict confidence. A postage paid return envelope is enclosed to return the questionnaire form.

Thank you for your cooperation.

ORANGE COUNTY SURVEY

Air pollution in the Los Angeles area consists of a variety of gases and particles. Some of these are emitted directly by pollution sources (cars, trucks, industrial facilities) while others are formed in the air from these directly emitted pollutants.

Ozone, the most important gaseous air problem in the South Coast Air Basin, is created when certain other emissions are exposed to sunlight. Ozone is an important air problem because of its effects on human health and well-being.

Please find and open the enclosed sheet of illustrations.

The left-hand side shows the daily maximum ozone concentrations in your area during August and September of this year.

The right-hand side presents a summary of known effects of breathing ozone on humans and experimental animals. The effects are the result of relatively short-term exposure to ozone concentrations that are possible in the South Coast Air Basin.

Ozone concentration in the air are measured in parts per hundred million. This is a common way of measuring ozone levels.

On this scale a measure of 5 is very clean air for the Los Angeles area. A rating of 40 is very smoggy.

The Federal Standard for ozone requires an hourly average concentration of ozone less than 12 (all references to ozone concentration will be in parts per hundred million).

A Stage One Ozone Episode is called when ozone concentrations exceed 20. A Stage Two Ozone Episode requires an hourly average of 35. There have been no Stage Three Ozone Episodes, which require a concentration of 50, since 1974.

Some of the effects of ozone levels are:

- Concentrations meeting the Federal Standard (0-12). Ozone levels in this range are identified as Situation A, GOOD air quality, on the illustration.

  - ODOR BRIEFLY NOTICEABLE

    Most people notice the pungent smell of ozone at concentrations around 2. At 5 the "smell" fades in about 5 minutes even if the ozone remains.

- Federal Standard violated (12-20). Ozone levels in this range are identified as Situation B, FAIR air quality, on the illustration.

- DECREASED ATHLETIC PERFORMANCE

  Athletes performing outdoors show slower speeds in running.

- LOWER RESISTANCE TO LUNG INFECTION

  Some laboratory animals get lung infections more readily.

- SENSITIVE ASTHMATICS HAVE MORE FREQUENT ATTACKS

  The people with asthma who are most sensitive to ozone have more frequent coughing spells.

o Stage One Ozone Episode (20-35). Ozone levels in this range are identified as Situation C, POOR air quality, on the illustration.

- COUGH, CHEST DISCOMFORT, HEADACHE

  Healthy adults notice discomfort in breathing, get headaches, and cough.

- MORE FREQUENT ASTHMA ATTACKS

  More frequent coughing spells are had by people with asthma.

- RED BLOOD CELL SPHERING

  Changes in the appearance of red blood cells were noticed in human volunteers.

- DECREASED VISION, CONCENTRATION

  Human volunteers exposed to ozone had decreased sharpness of vision and had more difficulty concentrating. This may contribute to the higher number of automobile accidents when ozone levels rise.

o Stage Two Ozone Episode (35-50). Ozone levels in this range are identified as Situation D, VERY POOR air quality, on the illustration.

- DECLINE IN LUNG FUNCTION IN HEALTHY INDIVIDUALS

  Human volunteers exposed to ozone at this level had a noticeable decrease in various lung functions. At this level ozone is certainly more than an inconvenience; it presents a health hazard to people.

All effects of ozone at lower concentrations continue at higher concentrations. In the right-hand-side of the illustration these effects are repeated as ozone levels rise. Ozone, however, is not usually the cause of eye irritation. Other pollutants in smog are responsible for the stinging eyes.

The left-hand side of the illustrations shows the daily high ozone concentration in your area during last August and September.

Please notice the very high readings just before Labor Day Weekend and three weeks later on September 22 and 23. Between these periods of high ozone levels was a period of exceptionally low ozone levels. Earlier in the summer there were rather large day-to-day variations in daily high ozone readings.

Friday, September 3, was a day with relatively high ozone concentrations in your area. It was the Friday before Labor Day weekend and is marked on the left-hand-side of the illustration with a solid arrow. This was a day with FAIR ozone levels such as Situation B as shown on the illustration. B, FAIR day.

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Friday, September 3?

_____ Yes _____ No (Please Check)

2. If you answered yes, which of these symptoms did you notice?

Symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____
Other (please name)	_____	

The principle source of emissions which yield ozone is exhaust from cars and trucks. Factories, refineries, and other industrial facilities, also produce a significant amount of emissions.

A reduction in ozone levels will require the use of more costly procedures in manufacturing and in higher operating costs for automobiles and trucks. All of this would be reflected in higher prices for goods and services.

Over the Labor Day weekend, ozone levels dropped some in your area, to Situation A. There were numerous other days in August and September with A, GOOD air quality.

Try to imagine a summer day with FAIR ozone levels such as Situation B as shown in the illustration.

Ozone levels could be reduced on that day by imposing regulations requiring the use of more expensive procedures as mentioned above. If such regulations were imposed you would be "paying" for an ozone reduction.

5. What is the most your household would be willing to pay to reduce the daily high ozone reading on that day from FAIR to GOOD?
Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

6. Answer only if you answered $.00 to question 3 above.

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

7. In what outdoor activities do you regularly participate? How often?

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging	_____	_____	_____
Sailing	_____	_____	_____
Tennis	_____	_____	_____
Surfing	_____	_____	_____
Swimming	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Do you change your behavior on days with high ozone levels? If so, how?

	At what levels of ozone? B	C	D
Drive less	____	____	____
Exercise at different hours	____	____	____
Stay indoors	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education:
- under 12 years _____
- High School _____
- College - no degree _____
- Bachelor's degree _____
- Post-graduate degree _____

15. Your age group:
- under 18 _____
- 18-24 _____
- 25-34 _____
- 35-44 _____
- 45-54 _____
- 55 & over _____

16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000-7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500-9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,999	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

20. Do you live in a detached house, duplex or apartment?

(1) House	(2) Duplex	(3) Apartment	(4) Mobile Home
_____	_____	_____	_____

21. Do you own or rent your home? ____owm ____rent

Hello:

I am part of a research team from the University of Wyoming, we are conducting a study related to air quality improvements. Air quality is a familiar topic to people who live in the Los Angeles area.

However, cleaning up the air involves certain costs to society in which all people will share in one way or another. We are interested in finding out whether it is worth it for the people in Los Angeles to pay these costs in light of the benefits they receive from cleaner air.

I would like to take a few minutes of your time to ask some questions. Your answers will be helpful in discovering whether pollution control is worthwhile.

[DO NOT READ ALOUD PASSAGES IN BRACKETS]

Before asking you the questions, I'd like to tell you a few things about ozone.

[SAN GABRIEL VALLEY INTERVIEW]

Air pollution in the Los Angeles area consists of a variety of gases and particles. Some of these are emitted directly by pollution sources (cars, trucks, industrial facilities) while others are formed in the air from these directly emitted pollutants.

Ozone, the most important gaseous air problem in the South Coast Air Basin, is created when certain other emissions are exposed to sunlight. Ozone is an important air problem because of its effects on human health and well-being.

Please look at this illustration.

[HAND ILLUSTRATION TO RESPONDENT]
[POINT TO LEFT SIDE]

The left-hand side shows the daily maximum ozone concentrations in your area during August and September of this year.

[POINT TO RIGHT SIDE]

The right-hand side presents a summary of known effects of breathing ozone on humans and experimental animals. The effects are the result of relatively short-term exposure to ozone concentrations that are possible in the South Coast Air Basin.

[POINT TO SCALE]

Ozone concentrations in the air are measured in parts per hundred million. This is a common way of measuring ozone levels.

[POINT TO "5" AND "40" ON SCALE]

On this scale a measure of 5 is very clean air for the Los Angeles area. A rating of 40 is very smoggy.

[POINT TO 12 ON CENTER SCALE]

The Federal Standard for ozone requires an hourly average concentration of ozone less than 12 (all references to ozone concentration will be in parts per hundred million).

[POINT TO '20' ON CENTER SCALE]

A Stage One Ozone Episode is called when ozone concentrations reach 20.

[POINT TO '35' ON CENTER SCALE]

A Stage Two Ozone Episode requires an hourly average of 35. There have been no Stage Three Ozone Episodes, which require a concentration of 50, since 1974.

Some of the effects of ozone levels are:

[POINT TO 'A' ON CENTER SCALE]

- [Concentrations meeting the Federal Standard (0-12).] Ozone levels in the range of 0 to 12 are identified as Situation A, GOOD [POINT TO 'A', THEN 'GOOD'] air quality, on the illustration.

Here we see

- ODOR BRIEFLY NOTICEABLE [POINT OUT]

This means

Most people notice the pungent smell of ozone at concentrations around 2. At 5 the "smell" fades in about 5 minutes even if the ozone remains.

- [Federal Standard violated (12-20).] Ozone levels of 12 to 20 are identified as Situation B, FAIR air quality,

[POINT TO 'B', THEN 'FAIR']

on the illustration.

Here we see that the effects are

- DECREASED ATHLETIC PERFORMANCE [POINT OUT]

  Athletes performing outdoors show slower speeds in running.

- SENSITIVE ASTHMATICS HAVE MORE FREQUENT ATTACKS [POINT OUT]

  The people with asthma who are most sensitive to ozone have more frequent coughing spells.

- LOWER RESISTANCE TO LUNG INFECTION [POINT OUT]

  Some laboratory animals get lung infections more readily.

- [Stage One Ozone Episode (20-35).] Ozone levels from 20 to 35

[POINT TO 'C', THEN 'POOR']

are identified as Situation C, POOR air quality, on the illustration.

The effects are

- COUGH, CHEST DISCOMFORT, HEADACHE [POINT OUT]

  Healthy adults notice discomfort in breathing, get headaches, and cough.

- MORE FREQUENT ASTHMA ATTACKS [POINT OUT]

  More frequent coughing spells are had by people with asthma.

- RED BLOOD CELL SPHERING [POINT OUT]
  Changes in the appearance of red blood cells were noticed in human volunteers.

- DECREASED VISION, CONCENTRATION

This was left off the illustration.

Human volunteers exposed to ozone had decreased sharpness of vision and had more difficulty concentrating. This may contribute to the higher number of automobile accidents when ozone levels rise.

[o Stage Two Ozone Episode (35-50).] Ozone levels from 35 to 50

[POINT TO 'D', THEN 'VERY POOR']

are identified as Situation D, VERY POOR air quality, on the illustration.

- DECLINE IN LUNG FUNCTION IN HEALTHY INDIVIDUALS [POINT OUT]
  Human volunteers exposed to ozone at this level had a noticeable decrease-in various lung functions. At this level ozone is certainly more than an inconvenience; it presents a health hazard to people.

Please note that effects of ozone at lower concentrations continue at higher concentrations. [POINT TO EACH LIST OF EFFECTS] In the right-hand-side of the illustration these effects are repeated as ozone levels rise. Ozone, however, is not usually the cause of eye irritation. Other pollutants in smog are responsible for the stinging eyes.

[POINT TO LEFT SIDE]

The left-hand side of the illustrations shows the daily high ozone concentration in your area during last August [POINT] and September [POINT].

Please notice the very high readings just before Labor Day Weekend [POINT TO PEAKS] and three weeks later on September 22 and 23. Between

these periods [POINT TO VALLEY] of high ozone levels was a period of exceptionally low ozone levels. Earlier in the summer there were rather large day-to-day variations in daily high ozone readings.

Now, I would like to ask you some questions. I will hold the illustration so you can mark your answers. [EXCHANGE ILLUSTRATION FOR CLIPBOARD, DISPLAY ILLUSTRATION FOR RESPONDENT]

Thursday, September 2, was a day with relatively high ozone concentrations in your area. It was the Thursday before Labor Day weekend [POINT TO PEAK] and is marked on the left-hand-side of the illustration with a solid arrow. This was a day with [SLIDE ACROSS TO ' VERY POOR'] VERY POOR ozone levels, such as Situation D as shown on the illustration. The first question is:

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Thursday, September 2?

_____ Yes _____ No [Please Check] Please check your answer

[IF NO, SKIP #2]

2. [If you answered yes,] which of these symptoms did you notice? Please mark your answer sheet. For instance, did you or a member of your family notice decreased vision? How about the other listed symptoms?

symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____
Other (please name)	_____	

[PREFACE MATERIAL FOR #3]

The principle source of emissions which yield ozone is exhaust from cars and trucks. Factories, refineries, and other industrial facilities, also produce a significant amount of emissions.

A reduction in ozone levels will require the use of more costly procedures in manufacturing and in higher operating costs for automobiles and trucks. All of this would be reflected in higher prices for goods and services.

Over the Labor Day weekend, ozone levels dropped some in your area, to Situation C. There were numerous other days in August and September with C, POOR air quality.

Most people would agree that they prefer lower ozone levels to higher levels. The next set of questions addresses changes in ozone concentration.

To establish a point of reference for changes, try to imagine a summer day with VERY POOR ozone levels, such as situation D as shown in the illustration.

Ozone levels could be reduced on that day by imposing regulations requiring the use of more expensive procedures as mentioned above. If such regulations were imposed you would be "paying" for an ozone reduction.

On your answer sheet are a series of amounts. Please circle the amount that is your answer to Question 3.

[READ #3]

3. What is the most your household would be willing to pay to reduce the daily high ozone reading <u>on that day</u> from VERY POOR to POOR? [Please circle your answer.]

$ .00	$ 2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

For Question 4, please circle the amount that

4. [What] is the most your household would be willing to pay to reduce the daily high ozone level <u>on that day</u> from VERY POOR to FAIR? [Please circle your answer.]

$ .00	$ 2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

For Question 5, the change is from VERY POOR to GOOD. [BE SURE THAT RESPONDENT UNDERSTANDS THIS IS TOTAL, NOT ADDITIONAL]

5. What is the most your household would be willing to pay to reduce the daily high ozone level <u>on that day</u> from VERY POOR to GOOD? Please circle your answer.

$ .00	$ 2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

If you answered zero for any questions, please answer Question 6.

6. [Answer only if you answered $.00 to questions 3 through 5 above.]

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

Would you answer Question 7 by indicating how often you engage in outdoor activities? For instance, do you hike rarely, occasionally or often? How about other activities whether or not they are listed?

7. [In what outdoor activities do you regularly participate? How often?]

Activity	Barely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging	_____	_____	_____
Sailing	_____	_____	_____
Tennis	_____	_____	_____
Surfing	_____	_____	_____
Swimming	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

If you change your behavior when ozone levels rise, please answer Question 8. For example, do you drive less if you know that the standard is violated?

8. [Do you change your behavior on days with high ozone levels? If so, how?]

	At what levels of ozone? B	C	D
Drive less	____	____	____
Exercise at different hours	____	____	____
Stay indoors	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____

The remaining questions about your and your family will be useful for analyzing peoples' responses to the questions already asked.

Your answers to all these questions are of course strictly confidential. Please mark your answers to the rest of the questions before

putting your answer sheet in this pouch. [CLOSE BINDER. DISPLAY OPEN POUCH WITH OTHER ANSWER SHEETS IN IT.]

Thank you.

[BE SURE TO GET ALL QUESTIONS ANSWERED]

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education:
- under 12 years _____
- High School _____
- College - no degree _____
- Bachelor's degree _____
- Post-graduate degree _____

15. Your age group:
- under 18 _____
- 18-24 _____
- 25-34 _____
- 35-44 _____
- 45-54 _____
- 55 & over _____

16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Do you live in a detached house, duplex, apartment or mobile home?

(1) House	(2) Duplex	(3) Apartment	(4) Mobile Home
_____	_____	_____	_____

20. Do you own or rent your home? ____own ____rent

21. Would you please indicate which of the following groups your annual before tax household income falls in:

_____ less than $5,000	_____ $25,000-29,999	_____ $55,000-59,999
_____ $ 5,000-7,499	_____ $30,000-34,999	_____ $60,000-64,999
_____ $ 7,500-9,999	_____ $35,000-39,999	_____ $65,000-69,999
_____ $10,000-14,999	_____ $40,000-44,999	_____ $70,000-74,999
_____ $15,000-19,999	_____ $45,000-49,999	_____ $75,000 and up
_____ $20,000-24,999	_____ $50,000-54,999	

SAN GABRIEL VALLEY SURVEY

#_____

ANSWER SHEET

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Thursday, September 2?

_____ Yes _____ No (Please Check)

2. If you answered yes, which of these symptoms did you notice?

Symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____

Other (please name) _____

3. What is the most your household would be willing to pay to reduce the daily high ozone reading on that day from VERY POOR to POOR? Please circle your answer.

$ .00	$ 2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

4. What is the most your household would be willing to pay to reduce the daily high ozone level on that day from VERY POOR to FAIR? Please circle your answer.

$ .00	$ 2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.90
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

5. What is the most your household would be willing to pay to reduce the daily high ozone level on that day from VERY POOR to GOOD? Please circle your answer.

$ .00	$ 2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

6. Answer only if you answered $.00 to questions 3 through 5 above.

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

7. In what outdoor activities do you regularly participate? How often?

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging	_____	_____	_____
Sailing	_____	_____	_____
Tennis	_____	_____	_____
Surfing	_____	_____	_____
Swimming	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Do you change your behavior on days with high ozone levels? If so, how?

	At what levels of ozone? B	C	D
Drive less	____	_____	_____
Exercise at different hours	____	_____	_____
Stay indoors	_____	_____	_____
_____	____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	____	_____	_____

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? _____Yes _____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education: under 12 years _____
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15. Your age group: under 18 _____
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16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Do you live in a detached house, duplex, apartment or mobile home?

(1) House (2) Duplex (3) Apartment (4) Mobile Home

_____ _____ _____ _____

20. Do you own or rent your home? ____own ____rent

21. Would you please indicate which of the following groups your annual before tax household income falls in:

_____less than $5,000 _____$25,000-29,999 _____$55,000-59,999

_____$5,000-7,499 _____$30,000-34,999 _____$60,000-64,999

_____$ 7,500-9,999 _____$35,000-39,999 _____$65,000-69,999

_____$10,000-14,999 _____$40,000-44,999 _____$70,000-74,999

_____$15,000-19,999 _____$45,000-49,999 _____$75,000 and up

_____$20,000-24,999 _____$50,000-54,999

Hello:

I am part of a research team from the University of Wyoming, we are conducting a study related to air quality improvements. Air quality is a familiar topic to people who live in the Los Angeles area.

However, cleaning up the air involves certain costs to society in which all people will share in one way or another. We are interested in finding out whether it is worth it for the people in Los Angeles to pay these costs in light of the benefits they receive from cleaner air.

I would like to take a few minutes of your time to ask some questions. Your answers will be helpful in discovering whether pollution control is worthwhile.

[DO NOT READ ALOUD PASSAGES IN BRACKETS]

Before asking you the questions, I'd like to tell you a few things about ozone.

[SAN FERNANDO VALLEY INTERVIEW]

Air pollution in the Los Angeles area consists of a variety of gases and particles. Some of these are emitted directly by pollution sources (cars, trucks, industrial facilities) while others are formed in the air from these directly emitted pollutants.

Ozone, the most important gaseous air problem in the South Coast Air Basin, is created when certain other emissions are exposed to sunlight. Ozone is an important air problem because of its effects on human health and well-being.

Please look at this illustration.

[HAND ILLUSTRATION TO RESPONDENT]
[POINT TO LEFT SIDE]

The left-hand side shows the daily maximum ozone concentrations in your area during August and September of this year.

[POINT TO RIGHT SIDE]

The right-hand side presents a summary of known effects of breathing ozone on humans and experimental animals. The effects are the result of relatively short-term exposure to ozone concentrations that are possible in the South Coast Air Basin.

[POINT TO SCALE]

Ozone concentrations in the air are measured in parts per hundred million. This is a common way of measuring ozone levels.

[POINT TO "5" AND "40" ON SCALE]

On this scale a measure of 5 is very clean air for the Los Angeles area. A rating of 40 is very smoggy.

[POINT TO "12" ON CENTER SCALE]

The Federal Standard for ozone requires an hourly average concentration of ozone less than 12 (all references to ozone concentration will be in parts per hundred million).

[POINT TO "20" ON CENTER SCALE]

A Stage One Ozone Episode is called when ozone concentrations exceed 20.

[POINT TO "35" ON CENTER SCALE]

A Stage Two Ozone Episode requires an hourly average of 35. There have been no Stage Three Ozone Episodes, which require a concentration of 50, since 1974.

Some of the effects of ozone levels are:

[o Concentrations meeting the Federal Standard (0-12).] Ozone levels in the range of 0 to 12 are identified as Situation A, GOOD

[POINT TO 'A', THEN 'GOOD']

air quality, on the illustration.

Here we see

• ODOR BRIEFLY NOTICEABLE [POINT OUT]

This means

Most people notice the pungent smell of ozone at concentrations around 2. At 5 the "smell" fades in about 5 minutes even if the ozone remains.

[o Federal Standard violated (12-20).] Ozone levels of 12 to 20 are identified as Situation B, FAIR air quality, on the illustration.

[POINT TO 'B', THEN 'FAIR']

• DECREASED ATHLETIC PERFORMANCE [POINT OUT]

Athletes performing outdoors show slower speeds in running.

• SENSITIVE ASTHMATICS HAVE MORE FREQUENT ATTACKS [POINT OUT]

The people with asthma who are most sensitive to ozone have more frequent coughing spells.

• LOWER RESISTANCE TO LUNG INFECTION [POINT OUT]

Some laboratory animals get lung infections more readily.

[o Stage One Ozone Episode (20-35).] Ozone levels from 20 to 35 are

[POINT TO 'C', THEN TO 'POOR']

identified as Situation C, POOR air quality, on the illustration.

• COUGH, CHEST DISCOMFORT, HEADACHE [POINT OUT]

Healthy adults notice discomfort in breathing, get headaches, and cough.

• MORE FREQUENT ASTHMA ATTACKS [POINT OUT]

More frequent coughing spells are had by people with asthma.

• RED BLOOD CELL SPHERING [POINT OUT]
Changes in the appearance of red blood cells were noticed in human volunteers.

• DECREASED VISION, CONCENTRATION

This was left off the illustration

Human volunteers exposed to ozone had decreased sharpness of vision and had more difficulty concentrating. This may contribute to the higher number of automobile accidents when ozone levels rise.

[o Stage Two Ozone Episode (35-50).] Ozone levels from 35 to 50 are

[POINT TO 'D' THEN 'VERY POOR']

identified as Situation D, VERY POOR air quality, on the illustration.

• DECLINE IN LUNG FUNCTION IN HEALTHY INDIVIDUALS [POINT OUT]

Human volunteers exposed to ozone at this level had a noticeable decrease in various lung functions. At this level ozone is certainly more than an inconvenience; it presents a health hazard to people.

Please note that effects of ozone at lower concentrations continue at higher concentrations. [POINT TO EACH LIST OF EFFECTS] In the right-hand-side of the illustration these effects are repeated as ozone levels rise. Ozone, however is not usually the cause of eye irritation. Other pollutants in smog are responsible for the stinging eyes.

[POINT TO LEFT SIDE]

The left-hand side of the illustrations shows the daily high ozone concentration in your area during last August [POINT] and September [POINT].

Please notice the very high readings just before and during Labor Day Weekend [POINT TO PEAKS] and three weeks later on September 22 and 23. Between these periods [POINT TO VALLEY] of high ozone levels was a period of exceptionally low ozone levels. Earlier in the summer there were rather large day-to-day variations in daily high ozone readings.

Now, I would like to ask you some questions. I will hold the illustration so that you can mark your answers.

[EXCHANGE ILLUSTRATION FOR CLIPBOARD; DISPLAY ILLUSTRATION FOR RESPONDENT]

Saturday, September 4, was a day with relatively high ozone concentrations in your area. It was the Saturday of Labor Day weekend [POINT TO PEAK] and is marked on the left-hand-side of the illustration with a solid arrow. This was a day with [SLIDE ACROSS TO 'POOR'] POOR ozone levels, such as Situation C as shown on the illustration. The first question is:

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Saturday, September 4?

_____ Yes _____ No [Please Check] Please check your answer

[IF NO, SKIP #2]

2. [If you answered yes,] which of these symptoms did you notice? Please mark your answer sheet. For instance, did you or a member of your family notice decreased vision? How about the other listed symptoms?

Symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____
Other (please name)	_____	

[PREFACE MATERIAL FOR #3]

The principle source of emissions which yield ozone is exhaust from cars and trucks. Factories, refineries, and other industrial facilities, also produce a significant amount of emissions.

A reduction in ozone levels will require the use of more costly procedures in manufacturing and in higher operating costs for automobiles and trucks. All of this would be reflected in higher prices for goods and services.

Over the Labor Day weekend, ozone levels dropped some in your area, to Situation B. There were numerous other days in August and September with B, FAIR air quality.

Most people would agree that they prefer lower ozone levels to higher levels. The next set of questions addresses changes in ozone concentration.

To establish a point of reference for changes, try to imagine a summer day with POOR ozone levels, such as Situation C as shown in the illustration.

Ozone levels could be reduced on that day by imposing regulations requiring the use of more expensive procedures as mentioned above. If such regulations were imposed you would be "paying" for an ozone reduction.

On your answer sheet are a series of amounts. Please circle the amount that is your answer to Question 4.

[READ #4; THERE IS NO #3]

4. What is the most your household would be willing to pay to reduce the daily high ozone reading on that day from POOR to FAIR?
[Please circle your answer.]

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

For Question 5, please circle the amount that

5. [What] is the most you would be willing to pay to reduce the daily high ozone level on that day from POOR to GOOD?
[Please circle your answer.]

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

If you answered zero for either question, please answer Question 6.

6. [Answer only if you answered $.00 to questions 4 through 5 above.]

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

Would you answer Question 7 by indicating how often you engage in outdoor activities? For instance, do you hike rarely, occasionally or often? How about other activities whether or not they are listed?

7. [In what outdoor activities do you regularly participate? How often?]

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging . . .	_____	_____	_____
Sailing . . .	_____	_____	_____

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Tennis	_____	_____	_____
Surfing . . .	_____	_____	_____
Swimming . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____

If you change your behavior when ozone levels rise please answer Question 8. For example, do you drive less if you know that the standard is being violated?

8. [Do you change your behavior on days with high ozone levels? If so, how?]

	At what levels of ozone? B	C	D
Drive less	____	____	____
Exercise at different hours	____	____	____
Stay indoors	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____

The remaining questions about you and your family will be useful for analyzing peoples' responses to the questions already asked.

Your answers to all of these questions are of course strictly confidential. Please mark your answers to the rest of the questions before putting your answer sheet in this pouch.

[CLOSE BINDER. DISPLAY OPEN POUCH WITH OTHER ANSWER SHEETS IN IT.]

Thank you.

[BE SURE TO GET ALL QUESTIONS ANSWERED]

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education:
- under 12 years _____
- High School _____
- College - no degree _____
- Bachelor's degree _____
- Post-graduate degree _____

15. Your age group:
- under 18 _____
- 18-24 _____
- 25-34 _____
- 35-44 _____
- 45-54 _____
- 55 & over _____

16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Do you live in a detached house, duplex, apartment or mobile home?

(1) Detached _____ (2) Duplex _____ (3) Apartment _____ (4) Mobile Home _____

20. Do you own or rent your home? ____own ____rent

21. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000-7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500-9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,999	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

SAN FERNANDO VALLEY SURVEY

#_____

ANSWER SHEET

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Saturday, September 4?

_____ Yes _____ No (Please Check)

2. If you answered yes, which of these symptoms did you notice?

Symptom	Yourself	Family Member
Decreased Vision		
More frequent asthma attacks		
Cough, Chest discomfort		
Other (please name)		

4. What is the most your household would be willing to pay to reduce the daily high ozone reading on that day from POOR to FAIR?
Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

5. What is the most you would be willing to pay to reduce the daily high ozone level on that day from POOR to GOOD?
Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	S75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

6. Answer only if you answered $.00 to questions 4 through 5 above.

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

7. In what outdoor activities do you regularly participate? How often?

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging . . .	_____	_____	_____
Sailing . . .	_____	_____	_____
Tennis	_____	_____	_____
Surfing . . .	_____	_____	_____
Swimming . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____
_____ . . .	_____	_____	_____

8. Do you change your behavior on days with high ozone levels? If so, how?

	At what levels of ozone? B	C	D
Drive less	_____	_____	_____
Exercise at different hours	_____	_____	_____
Stay indoors	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education:

under 12 years	_____
High School	_____
College - no degree	_____
Bachelor's degree	_____
Post-graduate degree	_____

15. Your age group:
- under 18 _____
- 18-24 _____
- 25-34 _____
- 35-44 _____
- 45-54 _____
- 55 & over _____

16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Do you live in a detached house, duplex, apartment or mobile home?

(1) Detached (2) Duplex (3) Apartment (4) Mobile Home

_____ _____ _____ _____

20. Do you own or rent your home? ____own ____rent

21. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000-7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500-9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,999	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

Hello:

I am part of a research team from the University of Wyoming, we are conducting a study related to air quality improvements. Air quality is a familiar topic to people who live in the Los Angeles area.

However, cleaning up the air involves certain costs to society in which all people will share in one way or another. We are interested in finding out whether it is worth it for the people in Los Angeles to pay these costs in light of the benefits they receive from cleaner air.

I would like to take a few minutes of your time to ask some questions. Your answers will be helpful in discovering whether pollution control is worthwhile.

[DO NOT READ ALOUD PASSAGES IN BRACKETS]

Before asking you the questions, I'd like to tell you a few things about ozone.

[ORANGE COUNTY INTERVIEW]

Air pollution in the Los Angeles area consists of a variety of gases and particles. Some of these are emitted directly by pollution sources (cars, trucks, industrial facilities) while others are formed in the air from these directly emitted pollutants.

Ozone, the most important gaseous air problem in the South Coast Air Basin, is created when certain other emissions are exposed to sunlight. Ozone is an important air problem because of its effects on human health and well-being.

Please look at this illustration.

[HAND ILLUSTRATION TO RESPONDENT]
[POINT TO LEFT SIDE]

The left-hand side shows the daily maximum ozone concentrations in your area during August and September of this year.

[POINT TO RIGHT SIDE]

The right-hand side presents a summary of known effects of breathing ozone on humans and experimental animals. The effects are the result of relatively short-term exposure to ozone concentrations that are possible in the South Coast Air Basin.

[POINT TO SCALE]

Ozone concentration in the air are measured in parts per hundred million. This is a common way of measuring ozone levels.

[POINT TO "5" AND "40" ON SCALE]

On this scale a measure of 5 is very clean air for the Los Angeles area. A rating of 40 is very smoggy.

[POINT TO "12" ON CENTER SCALE]

The Federal Standard for ozone requires an hourly average concentration of ozone less than 12 (all references to ozone concentration will be in parts per hundred million).

[POINT TO "20" ON CENTER SCALE]

A Stage One Ozone Episode is called when ozone concentrations exceed 20.

[POINT TO "35" on CENTER SCALE]

A Stage Two Ozone Episode requires an hourly average of 35. There have been no Stage Three Ozone Episodes, which require a concentration of 50, since 1974.

Some of the effects of ozone levels are:

[o Concentrations meeting the Federal Standard (0-12).] Ozone levels in the range of 1 to 12 identified as Situation A, GOOD

[POINT TO 'A', THEN 'GOOD']

air quality, on the illustration.

- ODOR BRIEFLY NOTICEABLE [POINT OUT]

This means

Most people notice the pungent smell of ozone at concentrations around 2. At 5 the "smell" fades in about 5 minutes even if the ozone remains.

[o Federal Standard violated (12-20).] Ozone levels of 12 to 20 are identified as Situation B, FAIR air quality, on the illustration.

[POINT TO 'B', THEN 'FAIR']

- DECREASED ATHLETIC PERFORMANCE [POINT OUT]

  Athletes performing outdoors show slower speeds in running.

- SENSITIVE ASTHMATICS HAVE MORE FREQUENT ATTACKS [POINT OUT]

  The people with asthma who are most sensitive to ozone have more frequent coughing spells.

- LOWER RESISTANCE TO LUNG INFECTION [POINT OUT]

  Some laboratory animals get lung infections more readily.

[o Stage One Ozone Episode (20-35).] Ozone levels from 20 to 35 are identified as Situation C, POOR air quality, on the illustration.

[POINT TO 'C', THEN 'POOR']

- COUCH, CHEST DISCOMFORT, HEADACHE [POINT OUT]

  Healthy adults notice discomfort in breathing, get headaches, and cough.

- MORE FREQUENT ASTHMA ATTACKS [POINT OUT]

More frequent coughing spells are had by people with asthma.

• RED BLOOD CELL SPHERING [POINT OUT]

Changes in the appearance of red blood cells were noticed in human volunteers.

• DECREASED VISION, CONCENTRATION

This was left off the illustration.

Human volunteers exposed to ozone had decreased sharpness of vision and had more difficulty concentrating. This may contribute to the higher number of automobile accidents when ozone levels rise.

[o Stage Two Ozone Episode (35-50).] Ozone levels from 35 to 50 are identified as Situation D, VERY POOR air quality, on the illustration.

• DECLINE IN LUNG FUNCTION IN HEALTHY INDIVIDUALS [POINT OUT]

Human volunteers exposed to ozone at this level had a noticeable decrease in various lung functions. At this level ozone is certainly more than an inconvenience; it presents a health hazard to people.

Please note that effects of ozone at lower concentrations continue at higher concentrations. [POINT TO EACH LIST OF EFFECTS] In the right-hand-side of the illustration these effects are repeated as ozone levels rise. Ozone, however, is not usually the cause of eye irritation. Other pollutants in smog are responsible for the stinging eyes.

[POINT TO LEFT SIDE]

The left-hand side of the illustrations shows the daily high ozone concentration in your area during last August [POINT] and September [POINT].

Please notice the very high readings just before Labor Day Weekend [POINT TO PEAKS] and three weeks later on September 22 and 23. Between these periods [POINT TO VALLEY] of high ozone levels was a period of exceptionally low ozone levels. Earlier in the summer there were rather large day-to-day variations in daily high ozone readings.

Now, I would like to ask you some questions. I will hold the illustration so that you can mark your answers.

[EXCHANGE ILLUSTRATION FOR CLIPBOARD; DISPLAY ILLUSTRATION FOR RESPONDENT]

Friday, September 3, was a day with relatively high ozone concentrations in your area. It was the Friday before Labor Day weekend

[POINT TO PEAK] and is marked on the left-hand-side of the illustration with a solid arrow. This was a day with [SLIDE ACROSS TO 'FAIR'] FAIR ozone levels such as Situation B as shown on the illustration. B, FAIR day. The first question is:

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Friday, September 3?

_____ Yes _____ No [Please Check] Please check your answer

[IF NO, SKIP #2]

2. [If you answered yes,] which of these symptoms did you notice? Please mark your answer sheet. For instance, did you or a member of your family notice decreased vision? How about the other listed symptoms?

Symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____
Other (please name)	_____	

[PREFACE MATERIAL FOR #5]

The principle source of emissions which yield ozone is exhaust from cars and trucks. Factories, refineries, and other industrial facilities, also produce a significant amount of emissions.

A reduction in ozone levels will require the use of more costly procedures in manufacturing and in higher operating costs for automobiles and trucks. All of this would be reflected in higher prices for goods and services.

Over the Labor Day weekend, ozone levels dropped some in your area, to Situation A. There were numerous other days in August and September with A, GOOD air quality.

Most people would agree that they prefer lower ozone levels to higher levels. The next question addresses changes in ozone concentration.

To establish a point of reference for changes, try to imagine a summer day with FAIR ozone levels such as Situation B as shown in the illustration.

Ozone levels could be reduced on that day by imposing regulations requiring the use of more expensive procedures as mentioned above. If such regulations were imposed you would be "paying" for an ozone reduction.

On your answer sheet are a series of amounts. Please circle the amount that is your answer to Question 5.

[READ #5; THERE IS NO #3 or #4]

5. What is the most your household would be willing to pay to reduce the daily high ozone reading on that day from FAIR to GOOD?
[Please circle your answer.]

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

If you answered zero please answer Question 6.

6. [Answer only if you answered $.00 to question 3 above.]

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.
_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.
_____ Other

Would you answer Question 7 by indicating how often you engage in outdoor activities? For instance do you hike rearely, occasionally or often? How about other activities whether or not they are listed?

7. [In what outdoor activities do you regularly participate? How often?]

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging	_____	_____	_____
Sailing	_____	_____	_____
Tennis	_____	_____	_____
Surfing	_____	_____	_____
Swimming	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

If you change your behavior when ozone levels rise, please answer Question 8. For example do you drive less if your know that the standard is being violated?

8. [Do you change your behavior on days with high ozone levels? If so, how?]

	At what levels of ozone? B	C	D
Drive less	____	____	____
Exercise at different hours	____	____	____
Stay indoors	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____

The remaining questions about you and your family will be useful in analyzing peoples' responses to the questions already asked.

Your answers to all of these questions are of course strictly confidential. Please mark your answers to the rest of the questions before putting your answer sheet in this pouch.

[CLOSE BINDER. DISPLAY OPEN POUCH WITH OTHER ANSWER SHEETS IN IT.]

Thank you.

[BE SURE TO GET ALL QUESTIONS ANSWERED]

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education:

under 12 years	_____
High School	_____
College - no degree	_____
Bachelor's degree	_____
Post-graduate degree	_____

15. Your age group: under 18 _____
18-24 _____
25-34 _____
35-44 _____
45-54 _____
55 & over _____

16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Do you live in a detached house, duplex or apartment?

(1) House (2) Duplex (3) Apartment (4) Mobile Home

_____ _____ _____ _____

20. Do you own or rent your home? ____own ____rent

21. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000-7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500-9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,999	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

ORANGE COUNTY SURVEY

#_____

ANSWER SHEET

1. Did you or any of the members of your immediate family experience any of the "ozone-induced" effects described above on Friday, September 3?

_____ Yes _____ No (Please Check)

2. If you answered yes, which of these symptoms did you notice?

Symptom	Yourself	Family Member
Decreased Vision	_____	_____
More frequent asthma attacks	_____	_____
Cough, Chest discomfort	_____	_____
Other (please name)_____		

5. What is the most your household would be willing to pay to reduce the daily high ozone reading <u>on that day</u> from FAIR to GOOD? Please circle your answer.

$ .00	$2.00	$4.00	$6.00	$8.00	$11.00	$15.00	$35.00
$ .50	$2.50	$4.50	$6.50	$8.50	$12.00	$20.00	$50.00
$1.00	$3.00	$5.00	$7.00	$9.00	$13.00	$25.00	$75.00
$1.50	$3.50	$5.50	$7.50	$10.00	$14.00	$30.00	$100.00

6. Answer only if you answered $.00 to question 3 above.

Did you bid zero because you believe that:

_____ You do not consider ozone to be a problem for you and your family.

_____ It is unfair or unjust to expect the victim of damages to have to pay the cost of preventing damages.

_____ Other

7. In what outdoor activities do you regularly participate? How often?

Activity	Rarely (1-5 days/year)	Occasionally (5-15 days/year)	Often (More than 15 days/year)
Hiking	_____	_____	_____
Jogging	_____	_____	_____
Sailing	_____	_____	_____
Tennis	_____	_____	_____
Surfing	_____	_____	_____
Swimming	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Do you change your behavior on days with high ozone levels? If so, how?

	At what levels of ozone? B	C	D
Drive less	____	____	____
Exercise at different hours	____	____	____
Stay indoors	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____
_____	____	____	____

9. How long have you lived at your present address? _____ years

10. How long have you lived in the Los Angeles area? _____ years

11. Did you consider air quality when choosing your home? ____Yes ____No

12. How much new information about air quality in the South Coast Air Basin and the effects of ozone did you find in the background material to this questionnaire?

none	very little	quite a bit	a great deal
_____	_____	_____	_____

13. Home zip code _____

14. Your education: under 12 years _____
High School _____
College - no degree _____
Bachelor's degree _____
Post-graduate degree _____

15. Your age group: under 18 _____
18-24 _____
25-34 _____
35-44 _____
45-54 _____
55 & over _____

16. Sex: _____Male _____Female

17. How many members are there in your household? _____persons.

18. Are you the primary income earner in your household? ___yes ___no

19. Do you live in a detached house, duplex or apartment?

(1) House (2) Duplex (3) Apartment (4) Mobile Home

_____ _____ _____ _____

20. Do you own or rent your home? ____own ____rent

21. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000-7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500-9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,999	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

APPENDIX B

I. INTRODUCTION

The makers of the public policy for our environment must be concerned with the effects their efforts have on consumer preferences. For instance, EPA-directed programs in the 1970's have led to research on the health, aesthetic, and property damage consequences of deteriorating air quality. As individuals become aware of these effects, we may expect their preferences for air quality, or the activities which use air quality, to change. Presuming a demand for air quality, we might hypothesize that the demand has increased (shifted to the right) for individuals as a result of this new information. In order to test this hypothesis, some technique must be used for estimating the demand relationship. Here, we examine the possibilities for using the hedonic technique and propose how it can be used to research the changing preferences issue.

The use of the hedonic technique to estimate the implicit (hedonic) prices of the characteristics or qualities of certain goods is becoming widely accepted in the Environmental and Urban economics fields. Its application to residential housing data, whereby, the value of a home is regressed against various site specific, because, these "goods" are not explicitly traded in markets. The resulting estimated implicit prices offer measures to the marginal values consumers reserve for such things as public safety, school quality, and air quality - all with public good qualities. Continuing refinements in estimation techniques make these estimates more and more reliable.[1]

Although the estimation of the hedonic prices has been widely accepted, using them to identify demand functions for the characteristics has not. Rosen (1974) proposed using the estimated hedonic prices, quantities, and consumer tastes and income information to estimate these demand curves. In principle, demand curves for public goods can be identified, because across a large urban area, their qualities are likely to vary. Thus, the hedonic technique reveals the implicit prices associated with the various qualities. The data appear similar to ordinary market data, and, when coupled with the information on consumers, the demand relationships would appear to be identifies.[2] Recently, several researchers have challenged Rosen's proposal (Brown and Rosen, 1982; Palmquist, 1981; and Mendelsohn, 1980). Their basic arguments suggest that the demands can only be identified-with multimarket data, perhaps from several urban areas.

In this appendix we purport to: (a) contribute to a better understanding of the new literature mentioned above; (b) outline the data requirements for implementing the hedonic technique to estimate the demands for public goods; and, (c) present some evidence of changing preferences and outline a complete empirical test of this hypothesis.

The remainder of the appendix has four sections. Section II contains an analysis of the hedonic technique to estimate demand relationships. In section III we present a short discussion of the data available for proceeding with estimation. We believe our data set will enable us to identify a demand for environmental quality. In the fourth section we address the issue of changing preferences. Evidence is presented which is not inconsistent with the hypothesis of preferences changing overtime. The

last section contains some concluding remarks.

II. DEMAND ESTIMATION

Our concern is with housing data so we restrict our analyses to this commodity class for the remainder of the paper. Let S, N, and Q represent a vector of site specific characteristics, a vector of neighborhood and locational characteristics, and a scalar measuring the environmental quality, respectively. Then, P(S,N,Q) is the hedonic function faced by consumers and producers in an urban area. It can be visualized by imagining consumers as "bidding" for the characteristics and producers "offering" the various characteristics at different prices. The hedonic function is the locus of tangencies between the consumers' bid functions and the producers' offer functions. Consumers will maximize utility by choosing the bundle of housing characteristics such that their indifference surface is just tangent to P(S,N,Q). With respect to Q, this implies that $\partial P/\partial Q = MRS_{Qy}$ where y is some numeraire commodity (money). The MRS measures the consumers' marginal willingness to pay for a marginal change in Q. For the ith individual, we denote this by: $W_i = \partial P/\partial Q$. Analogously, the producers will supply characteristic bundles so that their iso-profit loci are just tangent to the hedonic function.

By estimating P(S,N,Q), the $\partial P/\partial Q$ can be measured and, therefore, W_i. The major question concerns using these estimates to identify the demand for Q. The problem is simplied when the supply of available housing units can be assumed fixed at the various locations (Freeman, 1979). For this case, the consumers will bid for the homes with the desired characteristics; the simultaneity between demand and supply can be ignored. The supply of units appears relatively constant in the Los Angeles County area (see Table 1 below) and we make this assumption.[3]

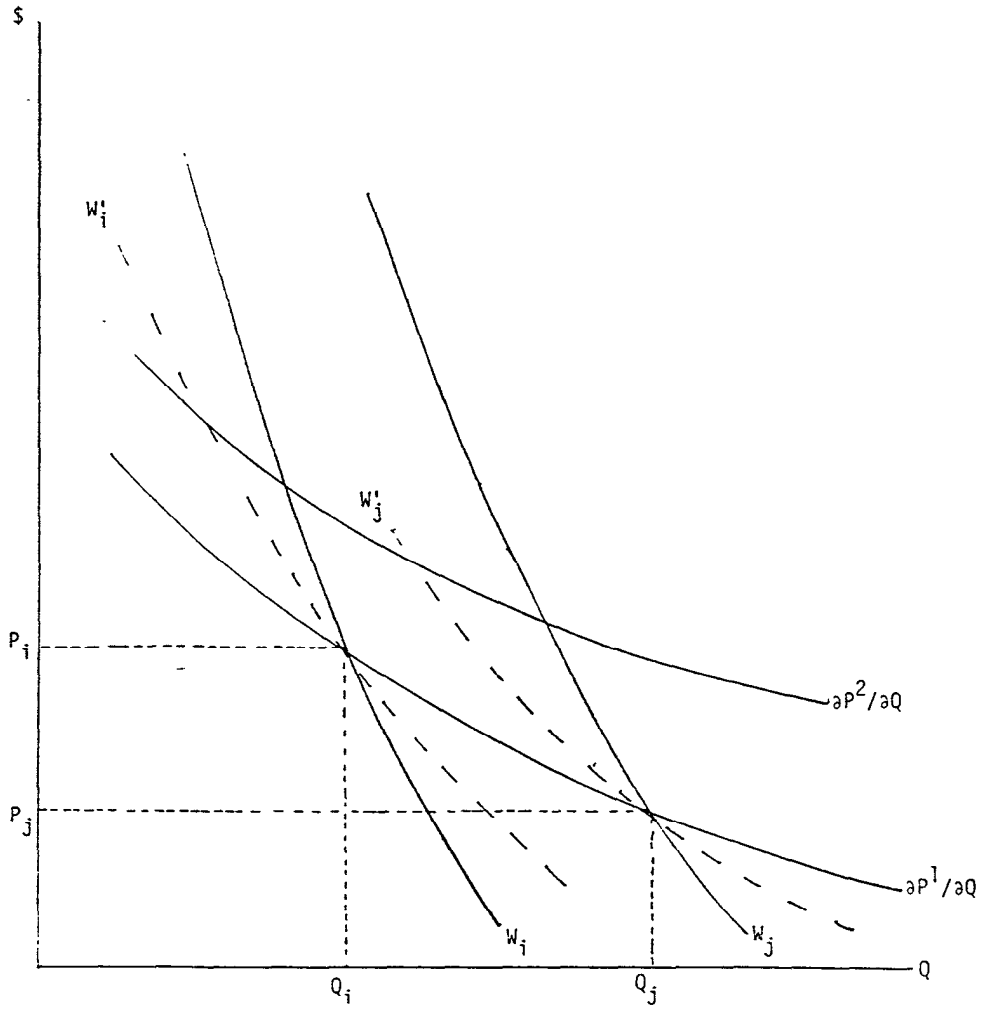
In general, there is no reason to expect that the hednoic function will be linear (Rosen, 1974, p. 38) so different prices will be revealed for different levels of Q. Furthermore, it is unlikely that the demand will be separable from the other characteristics. Using α to denote a vector of individual taste parameters (including income) the demand function can be represented by

$$W_i = W(S, N, Q, \alpha). \qquad (1)$$

Unfortunately,[4] the estimation of (1) will nqt identify the demand curve. To see this, consider Figure 1 where $\alpha P/\alpha Q$ is the estimated implicit price equation for Q. The optimal choice of Q for two individuals (i and j) is represented by Q_i and Q_j, revealing prices P_i and P_j, respectively. It appears as though we have price and quality variation. However, this results from the nonlinear hedonic equation. Different individuals will choose different quantities but, there are no data on how like individuals will react to different prices. The estimates of (1) will not differ between the demands W_i and W_i' or W_j and W_j'. Each demand curve yields precisely the same information.

To overcome these difficulties another hedonic function could be estimated using data from other markets.[5] The implicit price equation from another market is illustrated as $\partial P^2/\partial Q$ in Figure 1. The additional

Figure 1: The Implicit Price Function from Two Different Markets ($\partial P^1/\partial Q$ and $\partial P^2/\partial Q$) and Hypothetical Demand Curves for Two Individuals



information enables us to discern between W_1 and W_1', and W_J and W_J'. Obviously, the estimates of the demand function will improve as more and more markets are added to the data.[5]

III. DATA REQUIREMENTS

To estimate demand functions it is necessary to assume a utility function that is common to all individuals with the exception of measurable taste shift parameters. These are usually such variables and education, sex, age, and race. The use of multimarket data may rely on this assumption for diverse geographic regions. For example, data from Dallas, Texas could be merged with data from San Diego, California. The assumption would imply that individuals with the same sex, age, etc., from Texas would have the same preferences for environmental quality as those from California. This assumption may be too restrictive, in that, different preferences may be the cause of different hedonic gradients. Identical preferences for like individuals may be more defensible when different markets can be identified within a geographic region. The problem, then, is to identify the markets.

Mendelsohn (1980) suggests that a sufficient condition for hedonic functions to vary across markets is "that the underlying array of suppliers changes across the markets." Some examples would include different supply arrangements induced by building codes or realtor boards. Another sufficient condition noted by Mendelsohn: "if the number of demanders in a market is independent of the market prices, the supply curves are not perfectly elastic, and the number of demanders vary across markets." This would result when the transportation costs between markets are prohibitive (Palmquist, 1981). Therefore, we have some quide lines on defining different markets within a geographic region. A major task for future efforts is to design and implement statistical tests which may allow markets to be identified.

A data set is being assembled by the authors in conjunction with the Wyoming group which lends itself to these forms of analyses. The data are for several California counties, including two SMSAS, for several years in the 1970s. Ideally, a demand curve for Californians can be identified and compared to others from different geographical regions. Such a procedure may isolate variation in preferences for environmental quality between regions in the U.S.

IV. SHIFTING PREFERENCES

The possibility of the consumers' preferences changing over time can be examined by estimating demand equations from the same geographic region for several different time periods. The hypothesis of an increase in demand for environmental quality could then be tested statistically by comparing the demand for like individuals (with similar quantities of all characteristics) between the time periods. In theory, demand curves will exist for the individual in different time periods. And, under the assumption of constant preferences these demand curves would be identical.

Let $\bar{S}$, $\bar{N}$, $\bar{Q}$, and $\bar{\alpha}$ be the vectors of housing characteristics and measurable

taste parameters (including income), respectively. Use W_t and W_{t+1} to represent the demand equation estimated in year t and year t+1. Then, the null hypothesis is:

$$H_o: W_t(S, N, Q, \alpha) + W_{t+1}(\bar{S}, \bar{N}, \bar{Q}, \bar{\alpha})$$

and the alternative is:

$$H_A: W_t(\bar{S}, \bar{N}, \bar{Q}, \bar{\alpha}) < W_{t+1}(\bar{S}, \bar{N}, \bar{Q}, \bar{\alpha}).$$

Again, the California data set would facilitate this type of hypothesis testing.

As an initial investigation into this issue, the hedonic function for Los Angeles County has been estimated for 1972 and 1978 data. The means and standard deviations of the data are presented in Table 1 and the estimated coefficients from the regressions in Table 2. For the regressions, a semi-log functional form was used.

In Table 1, the means of the site specific characteristics (bathrooms, living area, fireplaces, etc.) are of particular interest. In comparing 1972 with 1978, we find only small changes in these measures. This is consistent with the assumption of a fixed supply of housing units discussed above. Unfortunately, data are not available from the 1980 census survey to compare the measures for the neighborhood characteristics. Intuitively, we expect these attributes to show some changes. Crime rates and school quality measures were obtained for the different periods. As suspected, a decline in the performance scores on standardized achievement tests is evidenced by the average scores of school quality. On the other hand, crime rates have remained remarkably stable. The 1975 total suspended particulates (TSP) measure is used to proxy air pollution in 1972 and 1978. As more and better air quality data becomes available, the estimation of these hedonic prices in different tine periods will be more precise.

The semi-log form is convenient for comparing estimates from different time periods. This is because the estimated coefficient is interpreted as the proportion of the house value devoted to the associated attribute. To see this, consider:

$$\partial(\text{Log } P)/\partial Q. \qquad (2)$$

Let Y = Log P, then:

$$\partial(\text{Log } P)/\partial Q = \partial Y/\partial P \cdot \partial P/\partial Q. \qquad (3)$$

From logarithmic differentiation the first derivative on the right hand side of (3) is 1/P. Thus, (2) is $(\partial P/\partial Q)/P$, which is the percentage change in the price due to a change in Q. Being a percentage, the measure is unit free; we do not need to consider the role of nominal dollars in housing markets. However, to actually compare hedonic prices, measures for price indices must be obtained. Fortunately, these data are available for Los Angeles County (see below).

The estimated coefficients presented in Table 2 allow for a comparison of the percentage of home value attributed to each characteristic in 1972

TABLE 1: MEANS AND STANDARD DEVIATIONS IN PARENTHESES FOR THE VARIABLES USED IN THE HEDONIC EQUATIONS FOR 1972 AND 1978 DATA.[a]

VARIABLE	1972	1978
SELLING PRICE (100s $)	311.69	831.22
	(172.76)	(565.50)
SALES DATE	6.62	5.31
	(3.25)	(2.82)
AGE OF THE HOME	24.31	27.16
	(12.94)	(16.92)
NUMBER OF BATHROOMS	1.61.	1.69
	(.65)	(.72)
SQUARE FEET OF LIVING AREA	1422.85	1437.94
	(619.18)	(625.25)
NUMBER OF FIREPLACES	.61	.66
	(.61)	(.61)
POOL [b]	.12	.13
	(.32)	(.34)
VIEW [b]	.04	.09
	(.21)	(.29)
SCHOOL QUALITY [c]	69.57	60.80
	(3.62)	(3.59)
DISTANCE TO BEACH [d]	11.50	12.53
	(7.50)	(7.68)
CRIME RATE [c]	.05	.05
	(.02)	(.02)
HOME DENSITY [c]	2273.98	2206.83
	(706.14)	(728.66)
PERCENTAGE OF POPULATION BLACK [d]	9.29	5.02
	(24.04)	(17.50)
PERCENTAGE OF POPULATION OVER 62 [d]	11.24	10.62
	(7.09)	(6.90)
EMPLOYMENT LOCATION [e]	.018	.018
	(.004)	(.004)
TOTAL SUSPENDED PARTICULATES [e]	106.63	108.23
	(13.86)	(14.13)

a. The sample sizis for 1972 and 1978 are 4688 and 4571 respectively.
b. Indicates a dumjy variable
c. Indicates a community specific variable.
d. Indicates a census tract specific varaible.
e. Calculated-Employment Location is calculated for each census tract by weighting the distance to eight employment centers by the employment density. Total suspended particulates are determined for each census tract by finding the closest monitoring stations. The average between the two closest is used unless these fall in the same direction from the census tract.

TABLE 2: ESTIMATED COEFFICIENTS OF HEDONIC EQUAITONS FOR THE 1972 AND 1978 DATA. THE DEPENDENT VARIABLE IS THE SELLING PRICE IN LOGS.

VARIABLE	1972	1978
SALES DATE	.0044	.0226
AGE OF THE HOME	-.0049	-.0025
NUMBER OF BATHROOMS	.1336	.1024
SQUARE FEET OF LIVING AREA	.0003	.0004
NUMBER OF FIREPLACES	.092	.1248
POOL	.1313	-0944
VIEW	.1348	.1489
SCHOOL QUALITY	.0081	.0180
DISTANCE TO BEACH	-.0099	-.0169
CRIME RATE	-.3053*	-.2342*
HOME DENSITY	-.00002	-.00004
PERCENTAGE OF POPULATION BLACK	-.0031	-.0075
PERCENTAGE OF POPULATION OVER 62	.0029	.0039
EMPLOYMENT LOCATION	-7.1023	-2.1254*
TOTAL SUSPENDED PARTICULATES	-.0018	-.0020
CONSTANT	4.9581	5.1958
R-Square	.80	.79
Number of Observations	4688	4571

* Indicates the coefficient is not significant at the .01 level.

and 1978. We find that the age of the home, number of bathrooms, employment distance, existence of a pool, and crime rates (although insignificant) appear to have diminished in the sense that they are all closer to zero. The remainder of the coefficients have increased between 1972 and 1978. Moreover, by using a t-test, statistical inferences can be made concerning these changes.

Focusing on the hypothesis of changing preferences for environmental quality, the t-statistic is calculated to compare the differences (in absolute value) between the coefficients for distance to the beach, view, and TSP (see Table 3). These are of interest because each could be considered a proxy for environmental quality. For example, the simple correlation coefficient between beach and TSP is .70 in both years. Although the simple correlation between view and these measures is slight (-.05 for TSP and -.07 for beach in 1978), it is likely that consumers would be willing to trade a view for more miles to the beach or pollution. Thus, this variable seems important to our analysis.

In Table 3 the t-statistics are presented along with the results from the hypothesis tests. The null hypothesis in each case is that the difference between the coefficients is zero, while the alternative is that the difference is positive. The null hypothesis is rejected for the distance to beach measures but can not be rejected for the other two. It is possible that the beach coefficient is picking up some of the effects of the pollution measure, thus, clouding the hypothesis test. This possibility highlights the importance of a correct econometric methodology for estimating the hedonic equation. In fact, multimarket data may help to break the correlation because the beach variable may not be as important in other areas of California.

The actual hedonic prices for beach, TSP, and view depend on the amounts of the other characteristics in the semi-log form. To examine the prices we examined a home sold in June, which is 25 years old, has one and a half baths, 1425 square feet of living area, a fireplace, and is without a pool or a view. Furthermore, the home is located in an area where the school quality measure is 65, the distance to the beach is 12 miles, the crime rate is .05, the surrounding home density is 2200 per square mile, and the percentages of the local population is 6 (i.e., population that is black), while the percentage greater than 62 years of age is 10 percent. The employment location parameter is .018 and TSP measure is 107. For this hypothetical home, the predicted hedonic prices for distance to the beach, TSP, and view are $273/mile, $49.7/PPM, and $3720, respectively, in 1972. While in 1978 the prices are $1410/mile, $167/PPM, and $12421, respectively. In comparing these figures, assume further that the home is located in the Pasadena area of L.A. County. Then, the housing price indices, with 1967 equal to 100, are 146 for 1972 and 338 for 1978. A comparison of the constant dollar figures is presented in Table 4. The beach price is substantially larger in 1978 while the others are somewhat closer.

These calculations are not conclusive. As stated above, an appropriate test will require the estimation of demand functions. However, they are most interesting since they are not inconsistent with the hypothesis of shifting preferences. In fact, they seem to be supportive.

V. CONCLUSIONS

The discussion above indicates that the hedonic housing value approach remains a technique with considerable research questions unanswered. These include demand curve identifications, changing preferences and others. However, the data sets now being assembled will enable hypothesis testing concerning these issues. The result will be an approach to value environmental goods which possesses considerable theoretical and empirical justification. Further, its use in validating other valuation approaches will also be increased substantially.

TABLE 3: RESULTS OF THE HYPOTHESIS TESTS COMPARING COEFFICIENTS BETWEEN 1972 AND 1978

Coefficient	t-Statistic	Conclusion
DISTANCE TO BEACH	7.254	Reject the null hypothesis
TSP	.42	Fail to reject
VIEW	.758	Fail to reject

The critical value for t is 2.33 at the .01 level.

TABLE 4: ESTIMATED HEDONIC PRICES IN CONSTANT 1967 DOLLARS FOR THE ENVIRONMENTAL QUALITY ATTRIBUTES (DOLLARS PER UNIT)

Good	1972	1978
DISTANCE TO BEACH	187	417
TSP	34	50
VIEW	2548	3675

FOOTNOTES

1. Evidence of the acceptability of estimated hedonic prices was recently published in the AER (Brookshire, et al.). In this paper, the authors used the hedonic prices to test the validity of survey responses.

2. The existing literature contains several examples of this approach. See Freeman (1979) for a review.

3. We are also neglecting the possibilities of market segmentation (Rosen, 1974, p. 40).

4. These comments are drawn mainly from Mendelsohn (1980).

5. In this section, we have only considered the theoretical problems in estimating the demand functions using the hedonic technique. There are econometric problems as well (Brown and Rosen, 1982).

APPENDIX C

SURVEY QUESTIONNAIRES AND ANSWER SHEETS

BUDGET GAME
URBAN SURVEY: Economic Narrative

We are students at the University of Wyoming and are conducting this survey for a research project designed to help in valuing visibility in Grand Canyon National Park in the southwestern United States.

The Clean Air Act, passed by Congress in 1970, declared a national goal of preserving the scenic beauty and pristine air quality of our national parks and wilderness areas.

Air quality, or the "cleanness" of the air, can be affected by either natural occurrences (e.g., dust and humidity) or by man-caused pollution (such as auto emissions or emissions released by industrial facilities). Consequently, visibility, which is the ability to see and appreciate distant objects, activities, scenes or atmospheric phenomena, can be affected by either natural or man-caused pollution sources resulting in changes in the color and clarity of near and far distant vistas.

As you can see in these photographs taken at the Grand Canyon, air pollution can discolor a view to the point where its components cannot be clearly identified and its scenic beauty cannot be fully enjoyed by the viewer [SHOW GRAND CANYON PHOTOGRAPHS: SITUATION A-E]

The photographs represent five levels of visibility during morning and afternoon periods looking both east and west from Hopi Point at the Grand Canyon. Column A represents poor visibility, B, below average; C, average visibility; D, above average; and E, good visibility. Comparing the columns, we can see the variety of air quality conditions and resulting levels of visibility that can be observed in the Grand Canyon. The rows represent the different vistas while standing at Hopi Point. The first row represents the different visibility and air quality conditions looking east, in the morning from Hopi Point. The second row represents morning conditions looking west from Hopi Point. The third row shows the view from Hopi Point in the afternoon looking west.

PAST AND FUTURE USE

In the first part of our survey, we would like to ask a few questions about your household's use of the National Parklands.

1. How many days have you spent visiting the Grand Canyon National Park in the last 10 years? Please put an X by the number of days on your answer sheet for question 1.

2. How many days do you expect to spend visiting the Grand Canyon National Park in the next 10 years? Please put an X by the number of days on your answer sheet for question 2.

PRESERVATION VALUE ANALYSIS

This part of the survey is designed to determine your concern for preserving visibility levels in Grand Canyon National Park.

Although one does not usually find a dollar value placed on scenery, sunsets or visibility, such things are valuable. Since it does cost money to clean up man-made pollution to improve visibility in our national parks, we are interested in finding out how much good visibility is worth to you.

Unless new and current industrial facilities in the southwest are required to meet current emission standards for particulates and sulfur oxides, air quality in the Grand Canyon will become less than the current average.

3. Would you please indicate the closest estimate of average monthly income for your household after taxes $_____.

[IF AN INDIVIDUAL CANNOT OR DOES NOT WANT TO REVEAL HIS MONTHLY INCOME, GIVE HIM A HYPOTHETICAL MONTHLY INCOME ON MUTUAL AGREEMENT, AND THEN CONTINUE WITH THE SURVEY]

The basic monthly expenses for most households are listed in the following table. Would you please break down your monthly income in the following categories, trying to be as accurate as possible.

Again, let us look at the photographs representing visual air quality ranging from very poor in Column A to very good in Column E for east and west views in the morning and afternoon from Hopi Point. If current emission standards are maintained, for new and existing power plants, average conditions will be as seen in Column C. If, however, current emission standards for sulfur oxide are not enforced, then the average air quality and visibility in the region will become like Column B. As a result, conditions as represented in Columns C, D, and E will occur less frequently. Conditions in Columns A and B would occur more frequently in the Grand Canyon. Such emission controls will likely make electricity more expensive.

4. We would like to know if you are willing to pay higher electric utility bills if the extra money collected would be used for air pollution controls to preserve current air quality and visibility levels at the Grand Canyon. Note, we want to find out how much preserving visibility at the Grand Canyon is worth to your household. In other words, how much extra would you be willing to pay at most, considering the amount of your expenses in the above-mentioned table, per month, as an increase in your electric utility bill to preserve current average visibility as represented in Column C rather than have the average

deteriorate to that shown in Column B? Please put an X next to the highest amount you would be willing to pay per month for your household on your answer sheet for question 4. [EMPHASIZE THEY ARE ANSWERING QUESTION 4].

[NOTE: IF INDIVIDUAL IS WILLING TO PAY, PLEASE ASK THE RESPONDENT TO REARRANGE HIS EXPENDITURES TO SHOW WHICH CATEGORY THE BID WILL COME FROM: IF BID COMES FROM "OTHER" CATEGORY, PLEASE ASK RESPONDENT TO BE MORE SPECIFIC].

BUDGET GAME

ANSWER SHEET

1. ____Zero Days
____1 day ____5 days ____ 9 days ____13 days
____2 days ____6 days ____10 days ____l4 days
____3 days ____7 days ____11 days ____15 days
____4 days ____8 days ____12 days ____More than 15 days

2. ____1 day ____5 days ____ 9 days ____13 days
____2 days ____6 days ____10 days ____14 days
____3 days ____7 days ____11 days ____15 days
____4 days ____8 days ____12 days ____More than 15 days

3. $_____

Household Expenses	Approx. Amount	Category Bid Will Come From
Electricity		
Shelter		
Entertainment (vacation, bowling recreation, Etc.)		
Savings		
Other (food, clothing, education, phone, water, insurance, transportation, Etc.)		
TOTAL		

Sum should equal monthly income

4. $ .00____/month $ 5.00____/month $30.00____/month $ 60.00____/month
.50____/month $10.00____/month $35.00____/month $ 70.00____/month
1.00____/month $15.00____/month $40.00____/month $ 80.00____/month
2.00____/month $20.00____/month $45.00____/month $ 90.00____/month
3.00____/month $25.00____/month $50.00____/month $100.00____/month
4.00____/month More than $100.00____/month

5. Answer only if you answered $.00 any part of the above question. Did you bid zero because you believe that:

_____The air quality improvements represented in the columns are not significant.

_____The source of the air pollution should be required to pay the costs of improving the air quality.

_____Other (specify)_____

_____

6. Home zip code _____

7. _____ Rural _____ Suburban ____Urban

8. Education: under 12 years _____
High School _____
College-no degree _____
Bachelor's degree _____
Post-graduate degree _____

9. Age group: under 18 _____
18-24 _____
25-34 _____
35-44 _____
45-54 _____
55 and over _____

10. Sex: ____Male ____Female

11. How many members are there in your household? _____persons.

12. Are you the primary income earner in your household? ___yes ___no

13. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	____$25,000-29,999	____$55,000-59,999
_____$ 5,000- 7,499	____$30,000-34,999	____$60,000-64,999
_____$ 7,500- 9,999	____$35,000-39,999	____$65,000-69,999
_____$10,000-14,999	____$40,000-44,999	____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,000	____$75,000 and up
____$20,000-24,999	____$50,000-54,999	

14. Please check the amount below which is closest to your average current monthly electricity bill.

$ .00 ___/month	$ 80.00 ___/month	$160.00 ___/month	$240.00 ___/month
10.00 ___/month	$ 90.00 ___/month	$170.00 ___/month	$250.00 ___. month
20.00 ___/month	$100.00 ___/month	$180.00 ___/month	$260.00 ___/month
30.00 ___/month	$110.00 ___/month	$190.00 ___/month	$270.00 ___/month
40.00 ___/month	$120.00 ___/month	$200.00 ___/month	$280.00 ___/month
50.00 ___/month	$130.00 ___/month	$210.00 ___/month	$290.00 ___/month
60.00 ___/month	$140.00 ___/month	$220.00 ___/month	$300.00 ___/month
70.00 ___/month	$150.00 ___/month	$230.00 /month	

Above $300.00 ___/month

15. Check if additional information was used. _____

THANK YOU

TEAM _____

BASE PLUS MAX WTP PLUS DENVER
URBAN SURVEY: Economic Narrative

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The Clean Air Act, passed by Congress in 1970, declared a national goal of preserving the scenic beauty and pristine air quality of our national parks and wilderness areas.

Air quality, or the "cleanness" of the air, can be affected by either natural occurrences (e.g., dust and humidity) or by man-caused pollution (such as auto emissions or emissions released by industrial facilities). Consequently, visibility, which is the ability to see and appreciate distant objects, activities, scenes or atmospheric phenomena, can be affected by either natural or man-caused pollution sources resulting in changes in the color and clarity of near and far distant vistas.

As you can see in these photographs taken at the Grand Canyon, air pollution can discolor a view to the point where its components cannot be clearly identified and its scenic beauty cannot be fully enjoyed by the viewer [SHOW GRAND CANYON PHOTOGRAPHS: SITUATION A-E]

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1. How many days have you spent visiting the Grand Canyon National Park in the last 10 years? Please put an X by the number of days on your answer sheet for question 1.

2. How many days do you expect to spend visiting the Grand Canyon National Park in the next 10 years? Please put an X by the number of days on your answer sheet for question 2.

PRESERVATION VALUE ANALYSIS

This part of the survey is designed to determine your concern for

preserving visibility levels in Grand Canyon National Park.

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Unless new and current industrial facilities in the southwest are required to meet current emission standards for particulates and sulfur oxides, air quality in the Grand Canyon will become less than the current average.

Again, let us look at the photographs representing visual air quality ranging from very poor in Column A to very good in Column E for east and west views in the morning and afternoon from Hopi Point. If current emission standards are maintained, for new and existing power plants, average conditions will be as seen in Column C. If, however, current emission standards for sulfur oxide are not enforced, then the average air quality and visibility in the region will become like Column B. As a result, conditions as represented in Columns C, D, and E will occur less frequently. Conditions in Columns A and B would occur more frequently in the Grand Canyon. Such emission controls will likely make electricity more expensive.

3. We would like to know if you are willing to pay higher electric utility bills if the extra money collected would be used for air pollution controls to preserve current air quality and visibility levels at the Grand Canyon. Note, we want to find out how much preserving visibility at the Grand Canyon is worth to your household. In other words, how much extra would you be willing to pay, at most, per month as an increase in your electric utility bill to preserve current average visibility as represented in Column C rather than have the average deteriorate to that shown in Column B? Please put an X next to the highest amount you would be willing to pay per month for your household on your answer sheet for question 3. [EMPHASIZE THEY ARE ANSWERING QUESTION 3].

4. Now suppose that with all households paying $_____ per month, this amount of money would be insufficient to allow for the preservation of visibility level C at the Grand Canyon. Would you be willing to pay ($_____ plus $1.00)? [CONTINUE BIDDING PROCESS TO MAXIMUM WILLINGNESS TO PAY].

5. Why did you bid zero?

6. Preserving air quality is also of concern in Denver and other urban areas. Suppose that someone just like me could ask you tomorrow how much you would be willing to pay to see air quality preserved in Denver. Would you still be willing to pay the $_____ you indicated for the Grand Canyon?

7. If no please indicate maximum willingness to pay for the Grand Canyon.

BASE + MWTP + DENVER

ANSWER SHEET

1. ____1 day ____5 days ____9 days ____13 days
____2 days ____6 days ____10 days ____14 days
____3 days ____7 days ____11 days ____15 days
____4 days ____8 days ____12 days ____More than 15 days

2. ____1 day ____5 days ____9 days ____13 days
____2 days ____6 days ____10 days ____14 days
____3 days ____7 days ____11 days ____15 days
____4 days ____8 days ____12 days ____More than 15 days

3. $_____ Grand Canyon

4. $_____ Maximum Bid

5. Answer only if you answered $.00 to question 3 above. Did you bid zero because you believe that:

____The air quality improvements represented in the columns are not significant.

____The source of the air pollution should be required to pay the costs of improving the air quality.

____Other (specify)_____

_____

_____

6. ____ yes ____ no; if no please answer question 7.

7. $_____ Grand Canyon

8. Home zip code _____

9. ____ Rural ____ Suburban ____Urban

10. Education: under 12 years ____
High School ____
College-no degree ____
Bachelor's degree ____
Post-graduate degree ____

11. Age group: under 18 _____
18-24 _____
25-34 _____
35-44 _____
45-54 _____
55 and over _____

12. Sex: _____Male _____Female

13. How many members are there in your household? _____persons.

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____$ 5,000- 7,499	____$30,000-34,999	____$60,000-64,999
____$ 7,500- 9,999	____$35,000-39,999	____$65,000-69,999
____$10,000-14,999	____$40,000-44,999	____$70,000-74,999
____$15,000-19,999	____$45,000-49,000	____$75,000 and up
____$20,000-24,999	____$50,000-54,999	

16. Please check the amount below which is closest to your average current monthly electricity bill.

$ .00___/month	$ 80.00___/month	$160.00___/month	$240.00___/month
10.00___/month	$ 90.00___/month	$170.00___/month	$250.00___.month
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30.00___/month	$110.00___/month	$190.00___/month	$270.00___/month
40.00___/month	$120.00___/month	$200.00___/month	$280.00___/month
50.00___/month	$130.00___/month	$210.00___/month	$290.00___/month
60.00___/month	$140.00___/month	$220.00___/month	$300.00___/month
70.00___/month	$150.00___/month	$230.00___/month	
Above $300.00___/month			

17. Check if additional information was used. _____

THANK YOU

TEAM_____

BUDGET CONSTRAINT PLUS MAXIMUM WTP
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We are students at the University of Wyoming and are conducting this survey for a research project designed to help in valuing visibility in Grand Canyon National Park in the southwestern United States.

The Clean Air Act, passed by Congress in 1970, declared a national goal of preserving the scenic beauty and pristine air quality of our national parks and wilderness areas.

Air quality, or the "cleanness" of the air, can be affected by either natural occurrences (e.g., dust and humidity) or by man-caused pollution (such as auto emissions or emissions released by industrial facilities). Consequently, visibility, which is the ability to see and appreciate distant objects, activities, scenes or atmospheric phenomena, can be affected by either natural or man-caused pollution sources resulting in changes in the color and clarity of near and far distant vistas.

As you can see in these photographs taken at the Grand Canyon, air pollution can discolor a view to the point where its components cannot be clearly identified and its scenic beauty cannot be fully enjoyed by the viewer [SHOW GRAND CANYON PHOTOGRAPHS: SITUATION A-E]

The photographs represent five levels of visibility during morning and afternoon periods looking both east and west from Hopi Point at the Grand Canyon. Column A represents poor visibility, B, below average; C, average visibility; D, above average; and E, good visibility. Comparing the columns, we can see the variety of air quality conditions and resulting levels of visibility that can be observed in the Grand Canyon. The rows represent the different vistas while standing at Hopi Point. The first row represents the different visibility and air quality conditions looking east, in the morning from Hopi Point. The second row represents morning conditions looking west from Hopi Point. The third row shows the view from Hopi Point in the afternoon looking west.

PAST AND FUTURE USE

In the first part of our survey, we would like to ask a few questions about your household's use of the National Parklands.

1. How many days have you spent visiting the Grand Canyon National Park in the last 10 years? Please put an X by the number of days on your answer sheet for question 1.

2. How many days do you expect to spend visiting the Grand Canyon National Park in the next 10 years? Please put an X by the number of days on your answer sheet for question 2.

PRESERVATION VALUE ANALYSIS

This part of the survey is designed to determine your concern for

preserving visibility levels in Grand Canyon National Park.

Although one does not usually find a dollar value placed on scenery, sunsets or visibility, such things are valuable. Since it does cost money to clean up man-made pollution to improve visibility in our national parks, we are interested in finding out how much good visibility is worth to you.

Unless new and current industrial facilities in the southwest are required to meet current emission standards for particulates and sulfur oxides, air quality in the Grand Canyon will become less than the current average.

3. Would you please indicate the closest estimate of average monthly income for your household after taxes $_____.

The-basic monthly expenses for most households are listed in the following table. Would you please break down your monthly income in the following categories, trying to be as accurate as possible.

Again, let us look at the photographs representing visual air quality ranging from very poor in Column A to very good in Column E for east and west views in the morning and afternoon from Hopi Point. If current emission standards are maintained, for new and existing power plants, average conditions will be as seen in Column C. If, however, current emission standards for sulfur oxide are not enforced, then the average air quality and visibility in the region will become like Column B. As a result, conditions as represented in Columns C, D, and E will occur less frequently. Conditions in Columns A and B would occur more frequently in the Grand Canyon. Such emission controls will likely make electricity more expensive.

4. We would like to know if you are willing to pay higher electric utility bills if the extra money collected would be used for air pollution controls to preserve current air quality and visibility levels at the Grand Canyon. Note, we want to find out how much preserving visibility at the Grand Canyon is worth to your household. In other words, how much extra would you be willing to pay at most, considering the amount of your expenses in the above-mentioned table, per month, as an increase in your electric utility bill to preserve current average visibility as represented in Column C rather than have the average deteriorate to that shown in Column B? Please put an X next to the highest amount you would be willing to pay per month for your household on your answer sheet for question 4. [EMPHASIZE THEY ARE ANSWERING QUESTION 4].

[NOTE: IF INDIVIDUAL IS WILLING TO PAY, PLEASE ASK THE RESPONDENT TO REARRANGE HIS EXPENDITURES TO SHOW WHICH CATEGORY THE BID WILL COME FROM: IF BID COMES FROM "OTHER" CATEGORY, PLEASE ASK RESPONDENT TO BE MORE SPECIFIC].

5. Now suppose that all households are paying $_____per month. This amount would be insufficient to allow for preservation of visibility level "C" at the Grand Canyon. Would you be willing to pay $_____ plus $1.00? [CONTINUE BIDDING PROCESS UNTIL MAXIMUM WTP]

BUDGET CONSTRAINT PLUS MAXIMUM WTP

ANSWER SHEET

1. ____zero days

____1 day	____5 days	____ 9 days	____13 days
____2 days	____6 days	____10 days	____14 days
____3 days	____7 days	____11 days	____15 days
____4 days	____8 days	____12 days	____More than 15 days

2.

____1 day	____5 days	____ 9 days	____13 days
____2 days	____6 days	____10 days	____14 days
____3 days	____7 days	____11 days	____15 days
____4 days	____8 days	____12 days	____More than 15 days

3. $_____
Monthly income

MONTHLY
HOUSEHOLD EXPENSES

Housing	
Food	
Recreation/ Entertainment	
Transportation	
Savings	
Other	

4. $_____
Initial Bid

5. $_____
Maximum Bid

6. Answer only if you answered $.00 to question 3 above. Did you bid zero because you believe that:

_____The air quality improvements represented in the columns are not significant.

_____The source of the air pollution should be required to pay the costs of improving the air quality.

_____Other (specify)_____

_____

_____

7. Home zip code _____

8. _____ Rural _____ Suburban ____Urban

9. Education:
under 12 years	_____
High School	_____
College-no degree	_____
Bachelor's degree	_____
Post-graduate degree	_____

10. Age group:
under 18	_____
18-24	_____
25-34	_____
35-44	_____
45-54	_____
55 and over	_____

11. Sex: ____Wale ____Female

12. How many members are there in your household? _____persons.

13. Are you the primary income earner in your household? ___yes ___no

14. Please check the amount below which is closest to your average current monthly electricity bill.

$ .00 ___/month	$ 80.00 ___/month	$160.00 ___/month	$240.00 ___/month
10.00 ___/month	$ 90.00 ___/month	$170.00 ___/month	$250.00 ___.month
20.00 ___/month	$100.00 ___/month	$180.00 ___/month	$260.00 ___/month
30.00 ___/month	$110.00 ___/month	$190.00 ___/month	$270.00 ___/month
40.00 ___/month	$120.00 ___/month	$200.00 ___/month	$280.00 ___/month
50.00 ___/month	$130.00 ___/month	$210.00 ___/month	$290.00 ___/month
60.00 ___/month	$140.00 ___/month	$220.00 ___/month	$300.00 ___/month
70.00 ___/month	$150.00 ___/month	$230.00 ___/month	

Above $300.00 ___/month

15. Check if additional information was used. _____

THANK YOU

TEAM _____

SOPG PLUS MAX WTP PLUS OTHER NATIONAL PARKS
URBAN SURVEY: Economic Narrative

We are students at the University of Wyoming and are conducting this survey for a research project designed to help in valuing visibility in Grand Canyon National Park in the southwestern United States.

The Clean Air Act, passed by Congress in 1970, declared a national goal of preserving the scenic beauty and pristine air quality of our national parks and wilderness areas.

Air quality, or the "cleanness" of the air, can be affected by either natural occurrences (e.g., dust and humidity) or by man-caused pollution (such as auto emissions or emissions released by industrial facilities). Consequently, visibility, which is the ability to see and appreciate distant objects, activities, scenes or atmospheric phenomena, can be affected by either natural or man-caused pollution sources resulting in changes in the color and clarity of near and far distant vistas.

As you can see in these photographs taken at the Grand Canyon, air pollution can discolor a view to the point where its components cannot be clearly identified and its scenic beauty cannot be fully enjoyed by the viewer [SHOW GRAND CANYON PHOTOGRAPHS: SITUATION A-E]

The photographs represent five levels of air quality conditions from very poor (A) to very good (E). The rows represent morning conditions for the Grand Canyon, Mesa Verde and Zion National Parks. Row 1 looks out from Hopi Point towards the east in the morning at the Grand Canyon. Row 2 represents the vista from Mesa Verde at Far View overlook towards the south in the morning. Finally, Row 3 is at Lava Point in Zion National Park looking southeast in the morning.

PAST AND FUTURE USE

In the first part of our survey, we would like to ask a few questions about your household's use of the National Parklands.

1. How many days have you spent visiting the Grand Canyon National Park in the last 10 years? Please put an X by the number of days on your answer sheet for question 1.

2. How many days do you expect to spend visiting the Grand Canyon National Park in the next 10 years? Please put an X by the number of days on your answer sheet for question 2.

3. How many days have you spent visiting National Parks in the southwest (Arizona, Utah, New Mexico, and Colorado) in the last 10 years? Please circle the number of days by each National Park on your answer sheet for question 3.

4. How many days for each National Park do you expect to visit in the next 10 years? Please circle the number of days by each National Park on your answer sheet for question 4.

PRESERVATION VALUE ANALYSIS

This part of the survey is designed to determine your concern for preserving visibility levels in Grand Canyon National Park.

Although one does not usually find a dollar value placed on scenery, sunsets or visibility, such things are valuable. Since it does cost money to clean up man-made pollution to improve visibility in our national parks, we are interested in finding out how much good visibility is worth to you.

Unless new and current industrial facilities in the southwest are required to meet current emission standards for particulates and sulfur oxides, air quality in the Grand Canyon will become less than the current average.

Again, let us look at the photographs representing visual air quality ranging from very poor in Column A to very good in Column E for east and west views in the morning and afternoon from Hopi Point. If current emission standards are maintained, for new and existing power plants, average conditions will be as seen in Column C. If, however, current emission standards for sulfur oxide are not enforced, then the average air quality and visibility in the region will become like Column B. As a result, conditions as represented in Columns C, D, and E will occur less frequently. Conditions in Columns A and B would occur more frequently in the Grand Canyon. Such emission controls will likely make electricity more expensive.

5. We would like to know if you are willing to pay higher electric utility bills if the extra money collected would be used for air pollution controls to preserve current air quality and visibility levels at the Grand Canyon. Note, we want to find out how much preserving visibility at the Grand Canyon is worth to your household. In other words, how much extra would you be willing to pay, at most, per month as an increase in your electric utility bill to preserve current average visibility as represented in Column C rather than have the average deteriorate to that shown in Column B? Please put an X next to the highest amount you would be willing to pay per month for your household on your answer sheet for question 3. [EMPHASIZE THEY ARE ANSWERING QUESTION 5].

6. Now suppose that with all households paying $_____ (Grand Canyon) and $_____(Regional) per month, this amount of money would be insufficient to allow for the preservation of visibility level C at the Grand Canyon. Would you be willing to pay $_____ plus $1.00 (Grand Canyon) and $_____ plus $1.00 (Regional)?

[CONTINUE BIDDING PROCESS TO MAXIMUM WILLINGNESS TO PAY].

[IF THE BID FOR QUESTION 6 IS ZERO THEN SKIP THE FOLLOWING TWO QUESTIONS

8. Preserving air quality is also of concern in other National Parks such as Yosemite, Yellowstone, the Petrified Forest, Mt. McKinley and others (NOTE: There are 77 other National Parks with 36 threatened by visibility deterioration). Suppose that someone just like me could ask you tomorrow how much you would be willing to pay to see air quality preserved in all these areas, would you still be willing to pay the $_____ (Grand Canyon) and $_____(Regional) you indicated for the Grand Canyon and other Parklands?

9. If no please indicate maximum willingness to pay for both the Grand Canyon and the other Parklands.

SOPG + MWTP + OTHER NATIONAL PARKS

ANSWER SHEET

1. ____1 day ____5 days ____ 9 days ____13 days
____2 days ____6 days ____10 days ____14 days
____3 days ____7 days ____11 days ____15 days
____4 days ____8 days ____12 days ____More than, 15 days

2. ____1 day ____5 days ____ 9 days ____13 days
____2 days ____6 days ____10 days ____14 days
____3 days ____7 days ____11 days ____15 days
____4 days ____8 days ____12 days ____More than 15 days

3. Zion Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15
Mesa Verde Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15
Bryce Canyon Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15
Canyonlands Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15

4. Zion Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15
Mesa Verde Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15
Bryce Canyon Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15
Canyonlands Nat. Park 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 +15

5. $_____ $_____
Grand Canyon Regional

6. $_____ $_____
Grand Canyon (Max Bit) Regional (Max Bid)

7. Answer only if you answered $.00 to question 3 above. Did you bid zero because you believe that:

_____The air quality improvements represented in the columns are not significant.

_____The source of the air pollution should be required to pay the costs of improving the air quality.

_____Other (specify)_____

_____

_____

8. _____ yes _____ no; if no please answer question 9.

9. $_____ $_____ (new bids)
Grand Canyon Regional

10. Home zip code _____

11. _____ Rural _____ Suburban _____Urban

12. Education: under 12 years _____
High School _____
College-no degree _____
Bachelor's degree _____
Post-graduate degree _____

13. Age group: under 18 _____
18-24 _____
25-34 _____
35-44 _____
45-54 _____
55 and over _____

14. Sex: _____Male _____Female

15. How many members are there in your household? _____persons.

16. Are you the primary income earner in your household? ___yes ___no

17. Would you please indicate which of the following groups your annual household income falls in:

_____less than $5,000	_____$25,000-29,999	_____$55,000-59,999
_____$ 5,000- 7,499	_____$30,000-34,999	_____$60,000-64,999
_____$ 7,500- 9,999	_____$35,000-39,999	_____$65,000-69,999
_____$10,000-14,999	_____$40,000-44,999	_____$70,000-74,999
_____$15,000-19,999	_____$45,000-49,000	_____$75,000 and up
_____$20,000-24,999	_____$50,000-54,999	

18. Please check the amount below which is closest to your average current monthly electricity bill.

$ .00___/month	$ 80.00___/month	S160.00___/month	$240.00___/month
10.00___/month	$ 90.00___/month	$170.00___/month	$250.00___.month
20.00___/month	$100.00___/month	$180.00___/month	$260.00___/month
30.00___/month	$110.00___/month	$190.00___/month	$270.00___/month
40.00___/month	$120.00___/month	$200.00___/month	$280.00___/month
50.00___/month	$130.00___/month	$210.00___/month	$290.00___/month
60.00___/month	$140.00___/month	$220.00___/month	$300.00___/month
70.00___/month	$150.00___/month	$230.00___/month	
Above $300.00___/month			

19. Check if additional information was used. _____

THANK YOU

TEAM_____

BUDGET CONSTRAINT PLUS SOPC PLUS MAX WTP
PLUS OTHER NATIONAL PARKS
URBAN SURVEY: Economic Narrative

We are students at the University of Wyoming and are conducting this survey for a research project designed to help in valuing visibility in Grand Canyon National Park in the southwestern United States.

The Clean Air Act, passed by Congress in 1970, declared a national goal of preserving the scenic beauty and pristine air quality of our national parks and wilderness areas.

Air quality, or the "cleanness" of the air, can be affected by either natural occurrences (e.g., dust and humidity) or by man-caused pollution (such as auto emissions or emissions released by industrial facilities). Consequently, visibility, which is the ability to see and appreciate distant objects, activities, scenes or atmospheric phenomena, can be affected by either natural or man-caused pollution sources resulting in changes in the color and clarity of near and far distant vistas.

As you can see in these photographs taken at Zion, Mesa Verde, and, the Grand Canyon, air pollution can discolor a view to the point where its components cannot be clearly identified and its scenic beauty cannot be fully enjoyed by the viewer [SHOW GRAND CANYON PHOTOGRAPHS: SITUATION A-E]

The photographs represent five levels of air quality conditions from very poor (A) to very good (E). The rows represent morning conditions for the Grand Canyon, Mesa Verde and Zion National Parks. Row 1 looks out from Hopi Point towards the east in the morning at the Grand Canyon. Row 2 represents the vista from Mesa Verde at Far View overlook towards the south in the morning. Finally, Row 3 is at Lava Point in Zion National Park looking southeast in the morning.

PAST AND FUTURE USE

In the first part of our survey, we would like to ask a few questions about your household's use of the National Parklands.

1. How many days have you spent visiting the Grand Canyon National Park in the last 10 years? Please put an X by the number of days on your answer sheet for question 1.

2. How many days do you expect to spend visiting the Grand Canyon National Park in the next 10 years? Please put an X by the number of days on your answer sheet for question 2.

3. How many days have you spent visiting National Parks in the southwest (Arizona, Utah, New Mexico, and Colorado) in the last 10 years? Please circle the number of days by each National Park on your answer sheet for question 3.

4. How many days for each National Park do you expect to visit in the next 10 years? Please circle the number of days by each National Park on your answer sheet for question 4.

PRESERVATION VALUE ANALYSIS

This part of the survey is designed to determine your concern for preserving visibility levels in Grand Canyon National Park.

Although one does not usually find a dollar value placed on scenery, sunsets or visibility, such things are valuable. Since it does cost money to clean up man-made pollution to improve visibility in our national parks, we are interested in finding out how much good visibility is worth to you.

Unless new and current industrial facilities in the southwest are required to meet current emission standards for particulates and sulfur oxides, air quality in the Grand Canyon will become less than the current average.

5. Would you please indicate the closest estimate of average monthly income for your household after taxes $_____.

The basic monthly expenses for most households are listed in the following table. Would you please break down your monthly income into the following categories, trying to be as accurate as possible.

Again, let us look at the photographs representing visual air quality ranging from very poor in Column A to very good in Column E for Grand Canyon, Mesa Verde and Zion national Parks.

If current emission standards are maintained, for new and existing power plants, average conditions will be as seen in Column C. If, however, current emission standards for sulfur oxide are not enforced,

Monthly
HOUSEHOLD EXPENSES

HOUSING/UTILITIES	
FOOD	
RECREATION/ ENTERTAINMENT	
TRANSPORTATION	
SAVINGS	
OTHER	
TOTAL INCOME: After Taxes	

then the average air quality and visibility in the region will be

represented as in Column B. As a result, conditions as represented in Colums C, D, and E will occur less frequently, and conditions in Columns A and B will occur more frequently. We would like to know how much the maintenance of average regional visibility is worth to you.

6. We would like to know if you are willing to pay higher electric utility bills if the extra money collected would be used for air pollution controls to preserve current air quality and visibility levels at the Grand Canyon and other Parklands. Note, we want to find out how much preserving visibility at the Grand Canyon and other Parklands is worth to your household. In other words, how much extra would you be willing to pay, at most, considering the amount of your expenses in the above-mentioned table, per month as an increase in your electric utility bill to preserve current average visibility as represented in Column C rather than have the average deteriorate to that shown in Column B? Please put an X next to the highest amount you would be willing to pay per month for your household on your answer sheet for question 6. [EMPHASIZE THEY ARE ANSWERING QUESTION 6].

7. Now suppose that with all households paying $_____ (Grand Canyon) and $_____(Regional) per month, this amount of money would be insufficient to allow for the preservation of visibility level C at the Grand Canyon. Would you be willing to pay $_____ plus $1.00 (Grand Canyon) and $_____ plus $1.00 (Regional)?

[CONTINUE BIDDING PROCESS TO MAXIMUM WILLINGNESS TO PAY].

[IF THE BID FOR QUESTION 7 IS ZERO THEN SKIP THE FOLLOWING TWO QUESTIONS]

9. Preserving air quality is also of concern in other National Parks such as Yosemite, Yellowstone, the Petrified Forest, Mt. McKinley and others (NOTE: There are 77 other National Parks with 36 threatened by visibility deterioration). Suppose that someone just like me could ask you tomorrow how much you would be willing to pay to see air quality preserved in all these areas, would you still be willing to pay the $_____ (Grand Canyon) and $_____(Regional) you indicated for the Grand Canyon and other Parklands?

10. If no please indicate maximum willingness to pay for both the Grand Canyon and the other Parklands.

BUDGET CONSTRAINT + SOPG + MAXIMUM WTP + ONP

ANSWER SHEET

1.

____1 day	____5 days	____ 9 days	____13 days
____2 days	____6 days	____10 days	____14 days
____3 days	____7 days	____11 days	____15 days
____4 days	____8 days	____12 days	____More than 15 days

2.

____1 day	____5 days	____ 9 days	____13 days
____2 days	____6 days	____10 days	____14 days
____3 days	____7 days	____11 days	____15 days
____4 days	____8 days	____12 days	____More than 15 days

3.

Zion Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15
Mesa Verde Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15
Bryce Canyon Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15
Canyonlands Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15

4.

Zion Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15
Mesa Verde Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15
Bryce Canyon Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15
Canyonlands Nat. Park	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	+15

5. $_____
Monthly Income

MONTHLY
HOUSEHOLD EXPENSES

HOUSING/UTILITIES	
FOOD	
RECREATION/ ENTERTAINMENT	
TRANSPORTATION	
SAVINGS	
OTHER	
TOTAL INCOME After Taxes	

6. $_____ Grand Canyon $_____ Regional

7. $_____ Grand Canyon (Max Bid) $_____ Regional (Max Bid)

8. Answer only if you answered $.00 to question 3 above. Did you bid zero because you believe that:

_____The air quality improvements represented in the columns are not significant.

_____The source of the air pollution should be required to pay the costs of improving the air quality.

_____Other (specify) _____

_____

_____

9. _____ yes ____ no; if no please answer question 9.

10. $_____ Grand Canyon $_____ Regional (new bids)

11. Home zip code _____

12. _____ Rural ____ Suburban ____Urban

13. Education:
- under 12 years ____
- High School ____
- College-no degree ____
- Bachelor's degree ____
- Post-graduate degree ____

14. Age group:
- under 18 ____
- 18-24 ____
- 25-34 ____
- 35-44 ____
- 45-54 ____
- 55 and over ____

15. Sex: ____Male ____Female

16. How many members are there in your household? _____persons.

17. Are you the primary income earner in your household? ___yes ___no

18. Please check the amount below which is closed to your average current monthly electricity bill.

$ .00 ___/month	$ 80.00 ___/month	$160.00 ___/month	$240.00 ___/month
10.00 ___/month	$ 90.00 ___/month	$170.00 ___/month	$250.00 ___.month
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50.00 ___/month	$130.00 ___/month	$210.00 ___/month	$290.00 ___/month
60.00 ___/month	$140.00 ___/month	$220.00 ___/month	$300.00 ___/month
70.00 ___/month	$150.00 ___/month	$230.00 ___/month	

Above $300.00 /month

19. Check if additional information was used. _____

THANK YOU

TEAM _____

COMPONENT VALUES STUDY
URBAN SURVEY: Economic Narrative

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As you can see in these photographs taken at the Grand Canyon, air pollution can discolor a view to the point where its components cannot be clearly identified and its scenic beauty cannot be fully enjoyed by the viewer [SHOW GRAND CANYON PHOTOGRAPHS: SITUATION A-E]

The photographs represent five levels of visibility during morning and afternoon periods looking both east and west from Hopi Point at the Grand Canyon. Column A represents poor visibility, B, below average; C, average visibility; D, above average; and E, good visibility. Comparing the columns, we can see the variety of air quality conditions and resulting levels of visibility that can be observed in the Grand Canyon. The rows represent the different vistas while standing at Hopi Point. The first row represents the different visibility and air quality conditions looking east, in the morning from Hopi Point. The second row represents morning conditions looking west from Hopi Point. The third row shows the view from Hopi Point in the afternoon looking west.

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2. How many days do you expect to spend visiting the Grand Canyon National Park in the next 10 years? Please put an X by the number of days on your answer sheet for question 2.

PRESERVATION VALUE ANALYSIS
-Grand Canyon-

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3. We would like to know if you are willing to pay higher electric utility bills if the extra money collected would be used for air pollution controls to preserve current air quality and visibility levels at the Grand Canyon. Note, we want to find out how much preserving visibility at the Grand Canyon is worth to your household. In other words, how much extra would you be willing to pay, at most, per month as an increase in your electric utility bill to preserve current average visibility as represented in Column C rather than have the average deteriorate to that shown in Column B? Please put an X next to the highest amount you would be willing to pay per month for your household on your answer sheet for question 3. [EMPHASIZE THEY ARE ANSWERING QUESTION 3].

[IF ZERO BID, SKIP TO QUESTION 6, AND THEN TO THE SOCIOECONOMICS QUESTIONS]

COMPONENT VALUES ANALYSIS

You have indicated that you would be willing to pay $_____/month to preserve the "C" level of air quality at the Grand Canyon. This section of the survey is designed to "break down" this dollar amount (or preservation value) into the several reasons why you might be willing to preserve "C" level air quality.

[IF INDIVIDUAL HAS INDICATED NON-USE, PROCEED TO PART II]

4. User Analysis.

a. The first reason you might be willing to pay for preservation is Actual User Value. That is, when you actually visit the Grand Canyon, you would rather have air quality at "C" rather than at "B". Category a, then, deals with actual use and is called Actual Use Value.

b. The second reason is Option of Use Value. Although you might be uncertain as to whether or not you will ever visit the Grand Canyon, you might be willing to pay to preserve your "Option of Use" to visit the Grand Canyon under conditions represented by "C" rather than those represented by "B". Option of Use Value can also be explained using automobfle insurance as an example. That is, an individual obtains automobile insurance because he believes there is a possibility that he might have an accident sometime in the future. So he is willing to pay his insurance premiums to maintain his "option of using" his insurance should he need it. Note that, on average you pay more in insurance premiums than you ever can expect to get back in damage collections.

In a similar manner, you may be uncertain about ever visiting the Grand Canyon, but you may be willing to pay to maintain the "option of using" the Grand Canyon under conditions represented by "C" rather than "B". Thus you may be willing to pay an extra amount above user value to insure good visibility at the Grand Canyon if you do decide to visit. Category b, then is called Option of Use Value.

c. The third reason is called Existence Value. Whether or not you ever visit the Grand Canyon, you are willing to pay soleiy to ensure the existence of air quality conditions at the Grand Canyon for the benefit of your generation as represented by "C" rather than those represented by "B". Therefore, just the knowledge that air quality conditions are being maintained has value. Thus, category c is called Existence Value.

d. The last part is closely related to existence value as defined above. However, in this case, you are willing to pay to preserve air quality conditions at the Grand Canyon for the benefit of future generations. Thus, part four represents a willingness to endow future generations with a preserved Grand Canyon and is called Bequest Value.

5. Non-User Analysis

a. The first reason you might be willing to pay for preservation is Option of Use Value. Although you might be uncertain as to whether or not you will ever visit the Grand Canyon, you might be willing to pay to preserve your "Option of Use" to visit the Grand Canyon under conditions represented by "C" rather than those represented by "B". Option of Use Value can also be explained using automobile insurance as an example. That is, an individual obtains automobile insurance because he believes there is a possibility that he might have an accident sometime in the future. So he is willing to pay his insurance premiums to maintain his "option of using" his insurance should he need it. Note that, on average, you pay more in

insurance premiums than you ever can expect to get back in damage collection.

In similar manner, you may be uncertain about ever visiting the Grand Canyon under conditions represented by "C" rather than "B". Category b, then is called Option of Use Value.

The next two parts are independent or separate from one's actual use of option to use. Rather, these categories deal with the simple existence of particular air quality conditions at the Grand Canyon.

b. Whether or not an individual visits the Grand Canyon, the individual may be willing to pay to ensure the existence of air quality conditions at the Grand Canyon for the benefit of his generation as represented by "C" rather than "B". Therefore, just the knowledge that air quality conditions are being maintained has value and this value is called Existence Value.

c. The last part is closely related to existence value as defined above. However, in this case, you are willing to pay to preserve air quality conditions at the Grand Canyon for the benefit of future generations. Thus, part four represents a willingness to endow future generations with a preserved Grand Canyon and is called Bequest Value.

SUPPLEMENT FOR OPTION OF USE VALUE

Assume you pay an insurance premium of $400.00 per year. Over your lifetime you may only get back $300/year in car repairs, etc. Therefore, you have paid $100 more than "necessary".

Of the total $400 you paid;

1. $300 is a user charge, that is, $300 of the premium was actually used for the accidents.

2. The remaining $100 is therefore the option premium paid in case of an unexpected drastic accident which may cost hundreds of thousands of dollars or even death.

In a similar manner, there may be some chance of an unplanned visit to the Grand Canyon, that is, an unexpected vacation, a sudden request made-by friends or relatives, etc. Since this uncertainty does exist, you may be willing to pay to keep open the "option of using" the Grand Canyon under air quality condition "C" as opposed to air quality condition "B".

COMPONENT VALUE STUDY

ANSWER SHEET

1. ____Zero Days

____1 day	____5 days	____ 9 days	____13 days
____2 days	____6 days	____10 days	____14 days
____3 days	____7 days	____11 days	____15 days
____4 days	____8 days	____12 days	____More than 15 days

2.

____1 day	____5 days	____ 9 days	____13 days
____2 days	____6 days	____10 days	____14 days
____3 days	____7 days	____11 days	____15 days
____4 days	____8 days	____12 days	____More than 15 days

3.

$ .00____/month	$ 5.00____/month	$30.00____/month	$ 60.00____/month
.50____/month	$10.00____/month	$35.00____/month	s 70.00____/month
1.00____/month	$15.00____/month	$40.00____/month	$ 80.00____/month
2.00____/month	$20.00____/month	$45.00____/month	$ 90.00____/month
3.00____/month	$25.00____/month	$50.00____/month	$100.00____/month
4.00____/month		More than	$100.00____/month

4. User Value $_____
   Option Value $_____
   Existence Valve $_____
   Bequest Value $_____

5. Option Value $_____
   Existence Value $_____
   Bequest Value $_____

6. Answer only if you answered $.00 any part of the above question.
   Did you bid zero because you believe that:

   _____The air quality improvements represented in the columns are not significant.

   _____The source of the air pollution should be required to pay the costs of improving the air quality.

   _____Other (specify)_____

   _____

7. Home zip code _____

8. _____ Rural _____ Suburban ____Urban

9. Education:
- under 12 years ____
- High School ____
- College-no degree ____
- Bachelor's degree ____
- Post-graduate degree ____

10. Age group:
- under 18 ____
- 18-24 ____
- 25-34 ____
- 35-44 ____
- 45-54 ____
- 55 and over ____

11. Sex: ____Male ____Female

12. How many members are there in your household? _____persons.

13. Are you the primary income earner in your household? ___yes ___no

14. Would you please indicate which of the following groups your annual household income falls in:

____less than $5,000	____$25,000-29,999	____$55,000-59,999
____$ 5,000- 7,449	____$30,000-34,999	____$60,000-64,999
____$ 7,500- 9,999	____$35,000-39,999	____$65,000-69,999
____$10,000-14,999	____$40,000-44,999	____$70,000-74,999
____$15,000-19,999	____$45,000-49,000	____$75,000 and up
____$20,000-24,999	____$50,000-54,999	

15. Please check the amount below which is closest to your average current monthly electricity bill.

$ .00___/month	$ 80.00___/month	$160.00___/month	$240.00___/month
10.00___/month	$ 90.00___/month	$170.00___/month	$250.00___.month
20.00___/month	$100.00___/month	$180.00___/month	$260.00___/month
30.00___/month	$110.00___/month	$190.00___/month	$270.00___/month
40.00___/month	$120.00___/month	$200.00___/month	$280.00___/month
50.00___/month	$130.00___/month	$210.00___/month	$290.00___/month
60.00___/month	$140.00___/month	$220.00___/month	$300.00___/month
70.00___/month	$150.00___/month	$230.00___/month	
Above $300.00 /month			

16. Check If additional information was used. _____

THANK YOU

TEAM_____